THE HAWAIIAN PLANTERS' MONTHLY

PUBLISHED FOR THE

HAWAIIAN SUGAR PLANTERS' ASSOCIATION

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PUBLICATION OF PLANTERS' MONTHLY DISCONTINUED.

The Trustees of the Hawaiian Sugar Planters' Association have decided to discontinue the publication of the Planters' Monthly with this issue.

The reasons for this action are several in number:

First, the necessity for the publication of the magazine, as a medium of communication between the sugar planters of Hawaii has largely been obviated by the numerous special publications and bulletins of the Hawaiian Sugar Planters' Association Experiment Station.

Moreover, beginning with last July that organization has been publishing a magazine for private circulation among the members of the Association, called "The Hawaiian Planters' Record." This publication, to a very large extent, covers the same field as the Planters' Monthly.

The reason given for the publication of this magazine is that there are many experiments and observations being carried on at the experiment station and its various sub-stations throughout the islands, as well as on individual plantations under the direction and supervision of the experiment station staff, information concerning which is proper for communication to other plantations; but which the experiment station staff do not wish to publish to the world, as the experiments are incomplete and they do not wish to commit themselves publicly until final results are obtained.

Another reason is the difficulty of securing the proper editorship of the magazine. A further reason is that the magazine never has been self-supporting; the Planters' Association having paid for the editing. Under the circumstances, it did not seem to the Trustees that the benefits derived warranted the expense of $600 per annum.

A number of the Trustees of the Association, as well as many private members, have been reluctant to discontinue the magazine, which has existed as the organ of the Hawaiian sugar planters since 1882; it having, therefore, just closed its twenty-seventh year. The discontinuance of the publication is precipitated by the present editor announcing his inability to continue to fulfill

the duties of the office and the failure on the part of the officers of the Association to secure a satisfactory successor.

The writer intensely regrets the discontinuance of publication of the magazine. It contains the only reliable and adequate history of the sugar industry of Hawaii, and has been invaluable as a means of information to local sugar planters of what was going on in the sugar world outside of this country, as well as a medium of conveying information from planter to planter as to what was going on in Hawaii itself. The writer does not believe that the publications of the Planters' Experiment Station adequately inform the large number of people in Hawaii, who are interested in sugar, of the general sugar news of the world. At best it conveys the information of what is going on at the experiment station itself and a brief review of similar work being done elsewhere; moreover it circulates among only a very few of the large number of people in Hawaii who are directly interested in sugar. The limited circulation of the Planters' Monthly does not, however, warrant any attempt to publish it as an independent magazine and the decision of the Trustees of the Association is, therefore, final.

In this final issue of the magazine it is not unfitting that a brief resumé should be given of the history of the magazine.

The first issue of the Planters' Monthly was in April, 1882; it beginning as a 16 to 24 page magazine, with extra pages for reporting annual meetings of the Planters' Company; its publication having been authorized by the Planters' Labor & Supply Company, which was organized the previous month. The magazine was under the editorship of a volunteer committee, consisting of W. O. Smith, S. B. Dole and W. R. Castle. The gentlemen resigned in the following October.

The Association thereupon authorized the Trustees to secure a paid editor and W. O. Smith was appointed to the position, he continuing to act from October, 1882, until May, 1885; when, upon his departure for California, L. A. Thurston was appointed editor. He held the position until November, 1886, when it was increased in size from twenty-four to forty-eight pages, and H. M. Whitney was appointed editor, the Hawaiian Gazette Company assuming cost of publication, the Planters' Company still paying for editing it. Mr. Whitney continued as editor until the time of his death, August, 1904. He was succeeded by R. D. Mead, then acting as the assistant secretary of the Planters' Association. At the time of the Japanese strike last May Mr. Mead's duties were so arduous as to prevent his being able to continue the editorship, and discontinuance of the magazine at that time was discussed. Action was postponed, however, on the offer of L. A. Thurston to edit the magazine to a date, until a suitable editor could be secured, not later than December, 1909.

The Planters' Monthly will go into history as a publication which has justified its existence. We hope that the time will soon come when a magazine devoted to sugar, which will be available for general circulation, may again be published in Hawaii.

REFUND BY PUBLISHERS OF PREPAID ADVERTISING AND SUBSCRIPTIONS.

Incidental to discontinuance of publication of the Planters' Monthly, the publishers hereby announce to advertisers that the amount prepaid for advertising, for the period yet unexpired, will be immediately refunded.

The publishers believe that the large number of readers, both at home and abroad, who have manifested an interest in the sugar news of Hawaii and of the world, by subscribing to the Planters' Monthly, as well as others, will continue to be interested in the subject. The publishers have therefore decided to add a "Sugar Department" to the "Sunday Advertiser," which will be mailed free for the balance of the term of unexpired subscriptions to the Planters' Monthly. Any subscriber who prefers refund of the amount of the unexpired subscription will receive payment of the same upon application at this office.

The Sunday Advertiser will be mailed, post paid, to any address in the United States or its possessions for $3.00 per annum; to foreign countries for $3.50 per annum, payable in advance.

HAWAIIAN GAZETTE COMPANY, LIMITED,
Publishers of the Planters' Monthly and of the Sunday Advertiser.

RAW SUGAR PRICES, AT NEW YORK, NOVEMBER 14 TO DECEMBER 13, 1909.

Date.	96° Centrifugals per lb.	96° Centrifugals per ton	88° Beets per 100 wt.	88° Beets per ton
Nov. 14	4.36¢	$87.20	12s 4½d	$92.40
" 15	"	"	12s 6d	93.00
" 16	4.43¢	88.60	12s 6¾d	93.40
" 17	"	"	12s 6d	93.00
" 18	"	"	12s 5¼d	92.80
" 19	"	"	12s 6d	93.00
" 20	4.36¢	87.20	12s 6d	93.00
" 22	"	"	12s 7½d	93.60
" 26	"	"	12s 6¾d	93.40
" 27	4.33¢	86.60	12s 7½d	93.60
" 29	"	"	12s 6¾d	93.40
" 30	"	"	12s 7½d	93.60
Dec. 1	"	"	12s 9d	94.00
" 3	4.315¢	86.30	12s 7½d	93.60
" 6	"	"	12s 6¾d	93.40
" 7	"	"	12s 7½d	93.60
" 10	4.24¢	84.80	12s 6d	93.00

THE SUGAR MARKET.

The year 1910 will open with nearly every sugar mill in Hawaii running at full capacity; with ideal weather both for grinding and for the young cane; with good prices in sight and an estimated crop of approximately the same tonnage as was harvested in 1909, the largest on record.

THE WORLD'S VISIBLE SUPPLY of sugar, as given by Willett & Gray, is as follows:

On Nov. 25, there was a shortage as against the same date in 1908, of 417,452 tons.

On Dec. 2, there was a shortage of 411,808 tons.

On Dec. 9, there was a shortage of 494,864 tons.

This showing, in view of the fact that there is an average annual increase of 5 per cent. in consumption, which, in view of the prosperous times, will probably be exceeded in 1910, forms a secure basis for the expectation of good prices for 1910. Detailed reports from various sugar producing countries is as follows:

PORTO RICO.—A severe storm on Nov. 27, destroyed in the field sugar to the estimated amount of 15,000 tons. Taking this into account, the estimated crop for 1910 is 280,000 tons, as against 245,000 tons for 1909 and 200,000 tons for 1908.

CUBA.—Grinding for the 1910 crop began Dec. 1.

On Dec. 2, the weather was favorable to cane. Estimate of 1910 crop is 1,800,000 tons.

Dec. 23 the first sugar was received for shipment abroad since November 1. Fifty-six mills were grinding on that date. Amended detail estimate of Cuban crop for 1910 is 1,831,400 tons from 175 mills. Another estimate, by a Havana paper, is 1,703,400 tons.

Willett & Gray express the belief that there is probably 1,800,000 tons in the field; but taking the usual difficulties from weather, insufficient capacity to care for the crops in season, etc., their estimate is for not to exceed 1,700,000 tons for 1910.

LOUISIANA.—On Dec. 2, two mills had completed grinding; but the majority would be grinding for another month.

The output from Sept. 1 to Nov. 26 was 86,027 tons as against 99,161 tons for the same period last year.

Dec. 23. The weather was cold and rainy, but most of the crop was already harvested.

The shortage of the crop owing to the September hurricane, is shown to have ranged from 25 to 40 per cent. in some localities.

The receipts at New Orleans, from Sept. 1 to Dec. 17 were 164,563 tons as against 170,828 tons for the same period in 1908.

MAURITIUS.—The estimated crop has been 220,000 tons as against 195,000 tons for 1908. The end of the crop is drawing near, however, and the indications are that the estimate will not be met.

PHILIPPINE ISLANDS.—On December 6th there was reported a sale at public auction of "friar lands" by the government of 55,000

acres in the island of Mindora, which is just south of the island of Luzon, on which Manila is located. The price paid was $367,000. The sale was to a Mr. Poole of Havana. It is reported that he represents interests which will develop the land in the cultivation of sugar, rice, hardwood, etc.

DEMERARA.—Weather conditions during November were reported as favorable. The giant moth borer (Castnia licus) is doing enormous damage to canes of all varieties. The ravages of this borer are extending year by year, and if some efficient means are not devised to keep it in check, it will render cane cultivation more or less impossible.

Reports state that "owing to the difficulty experienced in obtaining the laborers required to cut canes, and the exorbitant prices demanded, sugar making proceeds slowly. Canes are unusually short and dry and the yield of sugar below the average, owing to the abnormally wet weather which prevailed during the first six months of the year."

ARGENTINE.—Owing to heavy frosts the crop in the Argentine has fallen considerably below the original estimate, amounting to only 120,000 tons, which will require an importation of 35,000 tons to meet the consumption of the year.

JAVA.—The total shipments from May 1, 1909, to Oct. 30th, 1909, have been 713,926 tons as against 845,000 tons for 1908 and 740,000 tons for 1907.

BEET SUGAR IN THE UNITED STATES.—On Dec. 2nd, most of the Rocky Mountain and Pacific Coast factories had finished their campaigns after generally satisfactory results. A somewhat larger output is expected in California during 1910 than has been produced during 1909, but no radical increase is expected.

EUROPEAN BEET CROP.—F. O. Licht's estimate as of November 19th, 1909, is that the European beet crop will be 6,230,000 tons as against 6,517,000 tons actually produced in the 1908 campaign; 6,562,000 tons in the 1907 campaign; 6,710,000 tons in the 1906 campaign and 6,932,000 tons in the 1905 campaign.

On December 23rd Licht reduced his estimate to 6,170,000 tons, a reduction of 20,000 tons from previous estimate.

ANNUAL MEETING OF HAWAIIAN SUGAR PLANTERS' ASSOCIATION.

The Hawaiian Sugar Planters' Association held its regular annual meeting on November 15th to 18th last.

The Board of Trustees for 1909 was re-elected for 1910, consisting of S. M. Damon, E. D. Tenney, F. M. Swanzy, H. P. Baldwin, W. O. Smith, W. G. Irwin, E. F. Bishop, J. F. Hackfeld and F. A. Schaefer.

The Trustees elected the following officers for 1910, viz.:

W. G. Irwin, president; Wm. Pfotenhauer, vice-president; W. O. Smith, secretary; L. J. Warren, assistant secretary; G. H. Robertson, auditor.

An address was delivered by the retiring president, S. M. Damon, recounting the main subjects which had occupied the attention of the association during the year.

The report of the secretary also gave the usual summary incident to the secretary's report.

Reports were also made by C. C. Kennedy and W. W. Goodale upon the subject of cutting, handling and general transportation of cane;

By George F. Renton and H. B. Penhallow upon cultivation, fertilization and irrigation of cane;

By H. P. Baldwin upon stripped versus unstripped cane;

By A. Lidgate, John T. Moir, John Hind and W. P. Naquin upon cultivation and fertilization of unirrigated plantations;

A most comprehensive report on manufacture of sugar and the utilization of waste products was presented by Wm W. Goodale, embodying communications upon the subject from James W. Donald, chemist for Honokaa Sugar Company; G. Giacometti, chemist for Olaa Sugar Company; George Ross, manager of the Honolulu Plantation Company; J. A. Verret, chemist for Honolulu Plantation; J. F. Biela, chemist at Laupahoehoe Plantation; E. Madden, manager Kukaiau Mill; James Gibb, manager of Paauhau Plantation; J. R. Lougher, sugarboiler at Paauhau, and E. E. Batelle, chemist at Wailuku Plantation.

A report on sugar manufacturing machinery was submitted by J. N. S. Williams, embodying communications upon the subject by C. Hedemann, manager of the Honolulu Iron Works; Robert Hall, manager of Niulii Mill; W. G. Dyer, of the Honolulu Iron Works; F. E. Greenfield, chemist at Ewa Mill, and Wm. M. McQuaid, manager of the Kona Development Company.

A report on storage of raw sugar was made by E. K. Bull, manager of the Oahu Plantation, embodying a communication on the subject by James Gibb, manager of Paauhau Plantation.

A report on forestry in Hawaii was made by Ralph S. Hosmer, Territorial forester.

The length of the reports prevents their publication in full in the Planters' Monthly. Extracts from the report, such as the space will allow, are published herewith.

By the secretary's report it is shown that the crop for the year ending September 30th is the largest on record for the Territory, having amounted to 535,156 short tons.

The following is the output by islands, by plantations and by agencies:

HAWAIIAN SUGAR CROP FOR THE YEAR ENDING SEPTEMBER 30, 1909.

Hawaii.

Waiakea Mill Co	9,486	
Hawaii Mill Co., Ltd	2,838	
Hilo Sugar Co	12,291	
Onomea Sugar Co	14,416	
Pepeekeo Sugar Co	6,873	
Honomu Sugar Co	6,041	
Hakalau Plantation Co	11,586	
Laupahoehoe Sugar Co	8,004	
Ookala Sugar Plantation Co	6,646	
Kukaiau Plantation Co	2,225	
Kukaiau Mill Co	1,483	
Hamakua Mill Co	8,293	
Paauhau Sugar Plantation Co	9,315	
Honokaa Sugar Co	10,533	
Pacific Sugar Mill	5,263	
Niulii Mill and Plantation	2,768	
Halawa Plantation	1,135	
Kohala Sugar Co	5,570	
Union Mill Co	3,160	
Hawi Mill and Plantation	6,011	
Hutchinson Sugar Plantation Co	4,712	
Hawaiian Agricultural Co	11,406	
Puakea Plantation	992	
Olaa Sugar Co., Ltd	19,179	
Puako Plantation	835	
Kona Development Co	1,271	
		172,341

Maui.

Kipahulu Sugar Co	1,960	
Kaeleku Plantation Co	4,004	
Maui Agricultural Co	28,808	
Hawaiian Commercial & Sugar Co	52,725	
Wailuku Sugar Co	17,761	
Olowalu Co.	1,829	
Pioneer Mill Co., Ltd	27,518	
		134,605

Oahu.

Waimanalo Sugar Co	4,404	
Laie Plantation	829	
Kahuku Plantation Co	6,487	
Waialua Agricultural Co., Ltd	32,267	
Waianae Co.	6,469	
Ewa Plantation Co	33,949	
Apokaa Sugar Co., Ltd	432	
Oahu Sugar Co	34,651	
Honolulu Plantation Co	18,688	
Koolau Agricultural Co	247	
		138,423

Kauai.

Kilauea Sugar Plantation Co	4,975	
Makee Sugar Co	4,664	
Lihue Plantation Co	15,780	
Grove Farm Plantation	3,376	
Koloa Sugar Co	7,303	
McBryde Sugar Co., Ltd	13,686	
Hawaiian Sugar Co	23,788	
Gay & Robinson	3,354	
Waimea Sugar Mill Co	1,707	
Kekaha Sugar Co	10,385	
Estate V. Knudsen	769	
		89,787
Total crop		535,156

What the Agents Handle.

This output was handled by the various agents, as follows:

Alexander & Baldwin	112,637
H. Hackfeld & Co	106,036
Castle & Cooke	73,934
Wm. G. Irwin & Co	67,800
C. Brewer & Co	63,143
Theo. H. Davies & Co	50,884
Bishop & Co	19,179
F. A. Schaefer & Co	15,796
Hind, Rolph & Co	6,846
J. M. Dowsett	6,469
Henry Waterhouse Trust Co	5,481
Makee Sugar Co	4,664
Hawaiian Development Co	1,518
H. M. von Holt	769

THE LAST AND FUTURE PORTUGUESE IMMIGRATION.

The steamship "Swanley" arrived in Honolulu on December 14, having on board 874 Portuguese immigrants from the Azores and Madeira, consisting of 511 adults and 363 children.

This makes a total of 14,672 Portuguese who have immigrated to Hawaii since 1878, the date of the first arrivals.

This immigration, like all of its predecessors, was under the direct auspices of the Hawaiian Board of Immigration, all of the expenses of the venture being borne by the public treasury, out of the special 2 per cent. income corporation tax, imposed by the last legislature. In times past the expense of Portuguese immigration has been at times borne entirely by the Planters' Association; at times entirely by the government, and at times partly by one and partly by the other. Under existing Federal law the Territorial Board of Immigration alone can introduce immigrants from foreign countries, paying for the same out for appropriations made by the legislature.

The immigration was under the direct auspices of Mr. A. J. Campbell, recently treasurer of the Territory, acting as an agent of the Board of Immigration. Some criticism has appeared in the public press at the high cost of this immigration as compared to some previous importations from the same section and from other countries; the intimation apparently being that Mr. Campbell was in some way to blame therefor. A further suggestion is that Portuguese immigration is too expensive anyway, and that no further attempt should be made in that direction.

This criticism is entirely unjust to Mr. Campbell; moreover the Portuguese immigration is, on the whole, the most satisfactory of any that has been promoted to Hawaii. What is needed is more intelligent effort in promoting it in the future.

It has been repeatedly pointed out that the attempt to recruit upward of a thousand people to sail at one time in one ship from communities as small as those inhabiting the Azores and Madeira, on a voyage extending from a point off the African coast around South America to Hawaii is an extremely hazardous one. The hazard consists in the fact that there are no vessels regularly running upon the route; that a special steamer must be chartered for the purpose; that in order to reduce the pro rata cost per capita, a large number of immigrants must be recruited, which in turn means a large steamer, which in turns means a large sum of money. The charter party is usually for a lump sum, or per capita for the full capacity. If a large number of people are obtained, the pro rata cost is small. If, for any reason, they fail to materialize, the cost of the venture is distributed among a small number of people and, consequently, amounts to a very high per capita cost.

Repeated experiences, all pointing the same direction, have demonstrated that it is extremely difficult to secure the arrival of a chartered steamer at an exact date at distant points of departure.

The obstacles are many and the chances of delay and failure ever present.

As against a voyage of some fifteen thousand miles, to Hawaii, through the stormy Cape Horn section and twice across the equator, is a short trip by regular passenger steamers to the Atlantic coast of the United States, where there are many Portuguese already settled, and to Brazil, which is a Portuguese nation, where the immigrants are offered free passage, large areas of free land; governmental assistance in settling and liberal wages from established industries.

Every inducement is held out by recruiting officers for these other ports to go there instead of to Hawaii. False statements and rumors are circulated as to the unhealthfulness of the Hawaiian Islands; that the people are going to slavery; that their wages are low; that they will be ill treated, added to which are the terrors of the unknown. Every local influence at the point of departure is also against the Hawaiian immigration.

Under such circumstances, every direct immigration of great numbers who must all sail at an exact date, has been, and will continue to be, a direct gamble, with heavy odds against the Hawaiian end of the game.

No better settlers and laborers have ever come to Hawaii than the Spaniard and Portuguese, and every effort should be made to continue to secure immigrants from these sources; but once and for all, it should be decided to attempt no more direct immigration by chartered ships.

There are numerous vessels sailing from the Mediterranean to the Gulf, the coast of Mexico or Central America, which can be utilized for passage of whatever number of immigrants are ready to leave, at regular passenger rates. If there are only twenty-five immigrants ready to sail on the steamer, only twenty-five are paid for. There is no penalty for shortage in number arising out of circumstances which cannot be controlled.

Now that there is regular communication across the Tehuantepec railroad, arrangements can easily be made for direct steamer communication from the Pacific terminus of that railroad to Hawaii, by which more immigrants can be obtained in the foregoing way at a lower rate, than has ever been obtained by the Cape Horn route.

Laborers from Porto Rico and the Philippines are at best a stop gap to meet a difficult labor situation, and form poor material for good citizenship.

The lately inaugurated venture from Siberia is still an experiment. Whether the Russians from that section make good citizens or whether they will stay here after they arrive, is still an open question. We know that the Spaniards and the Portuguese will make both good laborers and good citizens, a combination devoutly to be desired.

Every effort should be made by the Board of Immigration to make arrangements along the lines above indicated for further immigration both from Portugal and her colonies and from Spain.

AMERICAN MOLASSES FEEDS.

The Hawaiian Planters' Record.]

The use of waste molasses for the manufacture of molasses feeds has become so extensive in the United States, that, according to J. E. Halligan, of the Louisiana State Experiment Station, "The time is coming when our manufacturers of commercial molasses feeds will be forced to obtain some of their supply of cane molasses from the tropical countries." In an article in the *Journal of Industrial and Chemical Engineering*, July, 1909, this writer defines the many feeds in which molasses forms an essential part, varying from 10 to 60 per cent. of the whole, and also describes the methods in which the mixture of the molasses with a multitude of food stuffs is effected. He calls attention to the need of careful handling of the molasses in order to prevent fermentation of the product, and writes that "According to a test run by a large manufacturer of molasses feeds, cane molasses seems to have better keeping qualities than beet molasses," and further, that "one manufacturer had to discontinue the use of beet molasses in his wet feed, (those which carry 25 per cent. or more of molasses), as fermentation invariably set in and decomposed the feed." The demand for molasses has become so great, that Louisiana planters are selling their blackstrap for $19 to $21 per ton (about 13 cents per gallon) and some manufacturers have been compelled even to buy second molasses for their purpose. Most factories use a mixture of beet and cane molasses, the latter rendering the feed more palatable and of a pleasant aroma.

S. S. PECK.

JAPANESE GOVERNMENT INDUSTRIES.

The London and China Telegraph publishes the following in regard to some of the Japanese government industrial operations for the past year:

The production of the Government Steel Foundry for the last financial year is roughly estimated at about 100,000 tons, of which the more important items are 20,000 tons of steel plate, 25,000 tons of rails, 7,000 tons of steel bars, 3,600 tons of angular bars, 5,000 tons each of flat and pig steels, and 2,500 tons of nickel-plated steel plates. Of the total production, over 80,000 tons have been already sold, of which 55,000 tons have been bought by the government and the rest by private firms.

According to official returns, the net profits arising from the Japanese government monopoly businesses for the forty-first fiscal year (April, 1908-March, 1909) amounted to $30,931,000 gold, against the estimate of $26,285,000, the excess of actual receipts over the estimate thus amounting to $4,646,000. During the

period under review camphor has brought in almost no profit, owing to the appearance of competitive articles in the market, coupled with the decrease in demand. The major part of the net profits has arisen from the tobacco and salt monopolies.

JAPANESE SHIPPING AND SUBSIDIES.

The following is a schedule of Japanese shipping subsidies, recently adopted by the Diet. The basis on which the several subsidies are paid to individual ships, is an allowance of 50 sen ($0.249) per gross ton, for each trip made:

Year.	European line.	North America.	South America.	Total.
1910	$1,602,660	$ 1,797,403	$ 299,785	$ 3,699,848
1911	1,578,579	2,226,146	363,498	4,168,223
1912	1,597,483	2,209,300	363,498	4,170,281
1913	1,614,230	2,146,814	361,270	4,122,314
1914	1,641,766	2,984,328	287,232	4,013,326
Total	$8,034,718	$10,463,991	$1,675,283	$20,173,992

The appropriation for the subsidy to the Australian line is not contained in this budget for the reason that an annual subsidy amounting to about $250,000 was granted by the Diet last year for five years, beginning with 1908.

According to the official statistics the number of merchant marine (steamers) of Japan at the end of 1908 was 1,618, with gross tonnage of 1,153,340.42 and 728,677.83 registered net tons. Of these 101 were steamers of more than 3,000 tons, aggregating 471,468.68 gross tons and 298,155.36 registered net tons.

SUGAR AS A FOOD IN JAPAN.

Housewives in Hawaii who may have noticed the penchant their Japanese servants have for sweets, particularly the sweets derived from melted granulated sugar in water, will be interested to learn that the habit is the outcome of a desire to increase their endurance capacity rather than satisfy a craving of the palate.

According to a statement made by Captain Kobayshi, of the Imperial Japanese army, appearing in the *Beet Sugar Gazette*: "We have been using, during the war, a very large quantity of sugar; according to my remembrance, almost 20 lbs. for a battery of 200 men, or 1.6 ounce as an average per man and per day, which gave our men an extraordinary endurance. I may add that we would have consumed a larger quantity, but for the fact that we had to pay for our sugar the exaggerated price of 9 cents per

lb. I wanted to point it out to you, knowing how interested you are in the questions concerning the sugar industry."

Recognition of the fact that sugar is a food, and a highly concentrated one, among the best for producing muscle and endurance, is shown further by the fact that the German army regulations now prescribe a regular ration of sugar to each soldier. The United States Navy now provides candy for its men, not as a luxury, but as a food. That the true character of sugar, as a food, and not as a luxury, is becoming known to the world at large is further evidenced by its constantly increasing consumption in all countries. This increase is so continuous and wide spread that producers may look forward with confidence to there being no serious overproduction of sugar for many years to come, if ever.

*LOSSES IN CANE SUGAR FACTORIES.**

The Hawaiian Planters' Record.]

The article under review comes from a distinguished French sugar technologist of twenty-five years' experience, and is designed to present a resume of the efficiency status of cane sugar factories as compared with beet sugar factories.

Mr. Pellet groups the sources of loss under five heads:

1. At extraction of juice.
2. During concentration of juice.
3. In residues.
4. In entrainment.
5. In mechanical losses.

EXTRACTION OF JUICE.—Mr. Pellet estimates the loss in bagasse as reaching a maximum of 2% to 3% per 100 cane and only in rare instances falling below .9% per 100 cane. As an average of good modern working, he places the limits as .9 to 1.1 per 100 cane. This statement can hardly be objected to; only four Java factories for the crop of 1908 reduced this loss to less than .9 per 100 cane, and for the same year seventeen Hawaiian factories had a smaller loss; if elsewhere there are sufficient factories to bring the total up to thirty, this would be a small number amongst the thousand or so cane sugar factories actually in existence, so that the qualification *"very rare"* is quite justified, although so high a loss may seem an overestimate when judged by purely local conditions.

DEFECATION AND CONCENTRATION.—Mr. Pellet estimates the weight of press cake as from .8 to 1.5 per 100 cane, a figure in accordance with local experience. The sucrose per cent. of the

* A paper read at the Seventh International Congress of Applied Chemistry.

press cake he estimates as 5% to 10%, a figure which, though doubtless accurate elsewhere, is much higher than ever found here, 2.72% being the average of the thirty-two mills included in the annual synopsis for 1908. In this connection Mr. Pellet calls attention to the *loss of sugar in the juice contained in the filter bags;* this point is well taken and is, I believe, not generally included in the loss due to filter presses.

We reproduce below Mr. Pellet's estimate of the total losses other than in bagasse and molasses. The item 2 has already been commented on and the item 4, a rather serious loss, is not supported by any data in his article and should not hence be at once accepted as existing in such large quantity.

1.	Canes chewed and juice drunk by employes	0.05
2.	Loss of sucrose in scums, press cake (average)	0.08
3.	Loss of sucrose in bags and filter cloths	0.05 to 0.08
4.	Loss by inversion during concentration (variable) from 1 to 2 per cent. on weight of sugar (canes containing 13 per cent. min.)	0.13
5.	Loss in condensed waters (entrainment)	0.05
6.	Entrainment from open vessels, estimated at	0.01
7.	By mechanical filtration of juice and syrups	0.05
8.	Overweight in bagging off the sugar	0.01
9.	Losses in cleaning out tanks and in the various sediments from unfiltered and filtered juices, syrups, etc	0.02
10.	Mechanical losses throughout the factory, including samples, loss of powdered sugar, etc	0.05
	Total	0.53

Mr. Pellet concludes his articles by urging the adoption of true purity and true sucrose (Clerget) determinations. With all he says on this score, this Station is in cordial agreement.

NOEL DEERR.

SUGAR DIVIDENDS IN GERMANY.

Much has been written about the healthy state of the sugar plantations in this Territory and the dividends paid during the past year have attracted no little attention from investors on the mainland; but Germany goes us one better. Below is given an extract from the *Frankfuerter Intelligencer,* which shows dividends equalled in few places in the world:

"The dividends that are being paid this year by most of the German raw sugar factories are quite considerable. In some cases there are increases which, as compared to those of last year can be called extraordinary and indeed surprising. Thus, most especially, the increase of the dividend of the raw sugar factory Radegast from 10 to 60 per cent.; but scarcely less remarkable is the increase of the factory Prosigh from 20 to 50 per cent. Both these factories are situated in the duchy of Anhalt.

The following increases of dividends of raw sugar factories are also quite remarkable: Anklam, Pomerania, from 15½ to 27 per cent.; Culmsee, West Prussia, from 10 to 20 per cent.; Dirschau, West Prussia, from 4 to 11 per cent.; Oberlausitzer Zuckerfabrik, from 5 to 8 per cent.; Salzwedel, Province of Saxony, from 4 to 7 per cent.; Altfelde, West Prussia, from 2 to 6 per cent.; Brakel, Westphalia, from 3 to 5 per cent. A large number of other sugar factories also distribute greatly increased amounts over last year.

Particularly high dividends are paid among others by the raw sugar factories at Friedland, Mecklenburg-Strelitz, 25 per cent.; Stavenhagen, Mecklenburg-Schwerin, 25 per cent. In the duchy of Brunswick the sugar factory, Jerxheim, pays 24, Wierthe 12 per cent.; in the duchy of Anhalt the sugar factory, Glauzig, pays 11½ per cent.; in the kingdom of Saxony the sugar factory, Markranstaedt, 10 per cent. In the province of Hanover, Nordheim yields 22½, Vienenburg 15, Linden 10 per cent. In the province of Saxony Koerbisdorf 10 per cent. Brandenburg is represented by the sugar factory, Nauen, with 15 per cent., Silesia by Froebeln with 12½ per cent.

In Pomerama, Straslund pays 14 per cent., Mescherin 10. In the province of Posen the sugar factory, Tuczno, gives a dividend of 25 per cent., Kruschwitz 21, and in West Prussia, Peplin 10 per cent. A large number of other factories are paying similar dividends or have proposed the payment of them. Altogether the year has been very good for the raw sugar factories. In a large measure this is due to the high sugar yields of the beets, but also to the fact that the factories were able to sell their sugar very profitably owing to extensive advance sales made at favorable opportunities on a large scale."

BEET SUGAR VERSUS CANE SUGAR.

This old conflict has been showing up recently in the State of Iowa, where Commissioner Wright, of the Dairy and Food Department of that State holds that under their law each kind of sugar should be sold for what it is, that is as either cane sugar or beet sugar. He has filed information against the Iowa Mercantile Co. of Newton and thus inaugurates what has been termed a campaign against a mild form of deception. The Des Moines Daily Capital quotes Commissioner Wright as stating that there is a popular prejudice in Iowa in favor of cane sugar and that it is more expensive and he believes that it has become a practice for dealers in that State to give customers beet sugar when they ask for cane sugar. He says that all dealers do not do it, but is convinced that many do so and considers them as violating the food laws of that State.

IRRIGATION OF SUGAR CANE IN PORTO RICO.

A government report upon irrigation of sugar cane in Porto Rico, quoted in Willett & Gray's Weekly for November 11, last, shows how similar the conditions are in that island to those in Hawaii. In both there is abundance of water on the windward, and a lack of it on the leeward side of the islands. In both, ditch systems have utilized all of the leeward water and expensive pumping plants are irrigating the rich dry lands at an annual cost of from $25.00 to $50.00 per acre. Hawaii has built and is building water systems costing millions of dollars, to bring the water from the windward side where it is not needed, to the leeward lands where it means life on what is now a desert. Porto Rico is about to do the same, as evidenced by the Government Report, September, 1909, which is as follows:

The Island of Porto Rico, though not over 100 miles from east to west and about 40 miles from north to south, shows a considerable variation in the distribution of rainfall. A range of mountains, with an average elevation of perhaps 2,000 feet and occa sional peaks rising to 3,000 feet and 3,500 feet, extends across the island south of the center, dividing it into a northern and southern division, with marked contrasts in rainfall conditions. On the north side of the divide the rainfall is abundant throughout the year. On the south side the rainfall is comparatively light, and varies greatly from month to month, with frequent droughts of long duration. The lowlands along the south shore are largely devoted to the cultivation of sugar cane. While streams are numerous, they are small and, during dry periods, unequal to the water requirements of the plantations. Practically all the waters of the rivers on the south side have been taken up in concessions granted to various property owners; in fact, many of the rivers can not supply the quantity of water called for in these concessions.

Recognizing the necessity for a greater and more constant water supply in the southern portion of the island, the Insular Legislature in 1907 appropriated the sum of $4,000 to determine the advisability of artificially irrigating the valuable cane lands of the south shore. The preliminary survey was so encouraging that in the following year the sum of $25,000 was appropriated for a more detailed survey, and an equal amount was appropriated for the year 1909. The results of investigations thus far made by the chief engineer, Mr. B. M. Hall, are contained in the annual report of the Governor of Porto Rico for 1908, from which the following account is drawn:

A careful investigation of conditions along the whole southern coastal plain, a distance of more than 80 miles, reveals the unmistakable fact that the great need of irrigation is fully appreciated. The low-water flow of all the local streams is entirely appropriated and conveyed in canals to the cane fields, and there are

many large and expensive pumping plants running day and night lifting ground water into flumes and canals for irrigation. In some of these pumping plants the operating expenses amount to $50.00 per year for each acre of land irrigated by them. It can be safely asserted that under the most favorable conditions in this region an acre of land can not be irrigated by pumps, using fuel for power, at a lower cost than about $25.00 per acre per year, and that under ordinary conditions the cost is much higher. Nevertheless, the number of pumping stations is constantly on the increase, and the planters have learned by experience that it pays to install large plants and pump water, even at a cost of $50.00 per acre per year. In fact, it is the difficulty of finding ground water to pump in many locations that has been the main cause of the demand for a general system of water supply from some more plentiful and more reliable source. Those planters who are pumping water are paying not less than $25.00 per acre per year for it, and frequently double that amount; yet there has been no complaint about the cost of this water. By proper irrigation the increase in the yield on land now in cultivation would amount to from $50.00 to $125.00 per year per acre. It is estimated that the loss on account of drought during 1907 and 1908 in the districts of Arroyo, Guayama, Salinas, Coamo, Santa Isabel and Ponce amounted to over four million dollars, the shortage being almost 57,000 tons of sugar. As all the early-plant cane was lost for want of rain this year, it is believed that the shortage in 1909 will be an additional two million dollars.

Surveys and stream measurements already made give very satisfactory results and show that an ample supply of water can be obtained from the region of the main divide and made available at moderate cost. Much of the water will be taken from the north side of the divide through tunnels from 1,000 feet to 3,000 feet in length.

Estimates of the cost of the two projects most carefully worked out at the present time (the Patillas and Carite projects) give the following figures for irrigating an area of 13,000 acres:

The Patillas dam	$ 420,000
The Patillas canal	300,000
Land for reservoirs	70,000
The Carite dam (La Plata River)	120,000
The Carite tunnel	90 000
Guamani canals and Melania reservoir	200,000
Land for reservoirs	15,000
	$1,215,000

WAGES IN CHILE.

For the information of those who claim that wages are low in Hawaii, we quote from U. S. Consular Report number 3507, giving the wages on railroads in Chile for June, 1909. Railroad labor is naturally paid higher wages than unskilled farm hands, and yet in 1908, after an increase of from 100 to 200 per cent. in wages in four years, the average wages of operatives on trains was 66 cents per day; on road-bed 56 cents per day, and in shops and round houses $1.55 per day, or a total average to 18,321 employes in all operative departments of 91 cents per day.

In a comparison with the world's wage scale Hawaii takes a high position.

The following is the official schedule of wages paid on Chilean railroad from 1905 to 1908, viz:

Year.	Operation.		Road bed.		Shops and round-houses.		Summary.	
	Number employed.	Daily wage.	Number employed.	Daily wage.	Number employed.	Daily wage.	Number employed.	Daily wage.
1905...	3,370	$0.38	5,163	$0.28	4,796	$0.53	13,329	$0.39
1906...	3,769	.49	5,150	.37	5,827	.90	14,746	.51
1907...	4,569	.56	7,568	.62	6,221	1.23	18,358	.80
1908...	5,068	.66	7,178	.56	6,074	1.55	18,321	.91

PRESIDENT'S ADDRESS.

The Hawaiian Planters' Record.]

Today marks the 29th Annual Meeting of the Hawaiian Sugar Planters' Association, and I am much gratified to see so many members present to participate in our proceedings. On behalf of the Trustees I have much pleasure in extending to you all a very cordial welcome and an appreciation of your attendance.

It appears to me that the presence at these annual sessions of every plantation manager who can possibly make arrangements to attend is a matter of special importance. The sugar business constitutes the main source of the wealth and prosperity of these Islands, and the success of that industry lies very largely in the hands of the men in charge of the executive branches of the work on the various plantations, and I believe no opportunity should be overlooked by any one of them of extending and perfecting their knowledge in relation to sugar production.

This annual sugar congress is intended to be educational in its character, its cardinal purpose being to bring out by discussion new ideas and the mutual exchange of knowledge and experience as to the best and latest economical methods of handling sugar affairs; but I trust the meeting will not be without profit and pleasure to all of us.

The year just passed has indeed been an eventful one in the annals of the Association. We have produced the largest crop which has, so far, been turned out from these Islands, we have enjoyed good prices, especially in the latter part of the season owing to the expected shortage of the European beet crop; the much dreaded tariff legislation has come and gone without affecting our industry in any way, and we have passed through a prolonged labor disturbance, learning lessons thereby which I firmly believe will make for a better feeling on all sides in the future.

Crops. Turning first to the question of our sugar production for 1909, I find that the year just closed has been a very successful one in every respect. It has been the record-breaking year of the Island sugar industry, our output being 535,156 tons, an increase of 14,033 tons over last year's crop, our previous highest record. And, coincident with a bumper crop, good prices have prevailed throughout the year, steadily improving as the season progressed. As has happened before, however, with an ascending market the bulk of our crops did not benefit by the higher prices, but nevertheless the average price received for our product has been an eminently satisfactory one.

Tariff. The results of the tariff legislation are well known to all of you, but a few words on this most important subject may not be out of place. In March of this year Congress met in extra session called for the purpose of passing a new Tariff Bill, now known as the "Payne Bill." The bill did not provide for any reduction in the duty on either raw or refined sugar, and as soon as the sugar schedule came up for discussion a bitter attack was made on the American Sugar Refinery with a view to showing that the larger portion of the increased price paid by the consumer on account of duties did not go to swell the revenue of the country but found its way into the pockets of the so-called Sugar Trust. Partly through the support afforded by the senators and representatives from the beet-growing states, and partly through his masterly tactics which were apparent all through the handling of this tariff measure, Senator Aldrich was enabled to ward off all reference to raw sugar in the bill, with this one exception—that 300,000 tons of raw sugar are each year admitted from the Philippines free of duty. The importance of the result achieved by the passage of the new tariff bill without any reduction in the sugar schedule is almost incalculable as far as we are concerned. At any rate it has put the whole of our industry on a solid basis, which is not likely to be disturbed for some time to come.

Strike. In the early part of May the Japanese laborers on several of the Oahu plantations went out on strike. Laborers were obtained from various sources to take their places and the work of the plantations was continued as usual. On August 5th

the strike was formally declared off, and from that time on the Japanese have been gradually returning to the various plantations where they were formerly at work.

Immigration. The question of immigration has been before your Trustees more or less during the whole of last year. One of the immediate results of the labor disturbance was to cause them to take in hand very vigorously the question of obtaining supplies of fresh labor from every available source. Messrs. Pinkham and Stevens were sent to the Philippines to revive native immigration from that point. They have forwarded thus far six or seven hundred people, who have taken hold of field work in a very satisfactory manner, being industrious and tractable. There are hopes of obtaining a goodly number of these people in the near future. By reason of the opening up of this immigration, Hawaii will obtain a very necessary supply of labor, and, apart from this possibly selfish consideration, has not the opportunity been offered us to assist the home government in Americanizing the Filipinos? Hawaii has been aptly termed the "Crossroads of the Pacific," where people of all nationalities meet and enter into commercial and agricultural competition. We bring from the Philippines several thousand laborers and their families, many of whom will return later to their country imbued with American ideals, having a better knowledge of labor as practiced away from their home surroundings and among people of all nationalities, and better fitted to meet the new conditions which must surely come to their own country, which has been for centuries practically isolated. The Hawaiian Islands have earned the reputation of conducting their political affairs in accordance with the methods practiced on the mainland. If the Filipino in his sojourn here on the different islands becomes acquainted with these methods, he returns to his country a better man physically and intellectually, and, we hope, politically.

The Territorial Board of Immigration is actively coöperating in the work of attracting desirable agricultural laborers to our shores. Under their auspices and with the approval and assistance of the authorities at Washington, Commissioner A. J. Campbell was despatched to Europe in search of Latin peasants. On Tuesday, October 26th, the steamer "Swanley" left Funchal, Madeira Islands, for Honolulu, with Mr. Campbell's first consignment of Portuguese immigrants. These people are due to arrive here the middle of next month.

Through the activities of Mr. A. L. C. Atkinson and a Russian gentleman, Mr. A. W. Perelstrous, the local Board of Immigration have also made a recent experimental importation of about fifty peasant families from the vicinity of Harbin, in Siberia. These Russians arrived October 21st and are now in process of being tried out as field hands on several different plantations Reports thus far indicate they are very promising material. If

they prove satisfactory as laborers it is probable that quite a number more of this class of immigrants will be brought to the Islands by the local Immigration Board. The bringing in of these agricultural laborers from Europe is so exactly in line with the policy laid down for us in Washington that I believe we may look for the same assistance and coöperation from the administration there in the furtherance of this immigration as we are now receiving in connection with that of the Portuguese. Mr. Atkinson, who has just returned, reports that a large number of these people can easily be brought here at a moderate expense, and that the difficulty is not to find people to come, but to discriminate between the large numbers who are ready and anxious to come to Hawaii.

Experiment Station. The work of the Experiment Station has been important as usual, and its purposes and progress for the past period will be fully reported on during this meeting. A new feature of its educational propaganda is the publication of a monthly paper to circulate among individuals or corporations directly connected with this organization. The objects of the "RECORD" were explained in its initial number issued July last, and I presume you all read the journal, so the value of its contents must be well known to you.

In connection with the Experiment Station affairs, the thanks of this Association are due to the various committees in charge of their respective departments. I take this occasion to express the thanks of the Association to Mr. F. M. Swanzy, Chairman of the Experiment Station Committee, who has devoted so much of his time and ability to the interests of the institution during the past year. All the members of the staff have devoted themselves with zeal to the work assigned them, and I cannot allow this occasion to pass without expressing the sense of appreciation which the Association owes to Mr. Muir for his search, under the most trying circumstances, for a parasite for the borer. Mr. Perkins, even while on vacation, has the vital interests of the organization in mind and is always at the service of the Association when required.

The practical work of Mr. Eckart, the able Director of the Station, has been as usual of the greatest benefit to the sugar interests of the Territory, and especially might be mentioned his study on improved fertilization during the year, the results of which appeared a few months ago in Bulletin No. 29. Through the considerations outlined by him, based on data obtained from exhaustive experimentation, Mr. Eckart feels convinced that an average gain of 10% over present gross yields can be effected on our plantations without any additional cost. This is a very notable expression of expert opinion on an important subject and should have due influence with managers in their future fertilization practices.

In taking into consideration the large yields per acre on the different islands and the number of men employed in their production, the public lose sight of the fact that without the most careful and scientific analysis of soil, selection and composition of fertilizer, the time and quantity of irrigation, and the most careful study of improved methods of manufacture of sugar in the mill, yields of the size and quality at present produced would be impossible. We would revert to the sixties and seventies, to the days of the open train and oxteams, when three tons to the acre was considered a phenomenal yield.

Plans for reorganization of certain details in connection with the management have been submitted by the Experiment Station Committee. These plans have been approved by the Trustees, and it is believed will make for additional efficiency in the conduct of this Department.

Since the last Annual Meeting this organization has lost by death one of its most prominent and valued members in the person of the late C. M. Cooke. Our departed friend and colleague was largely interested, directly and indirectly, in the predominant industry of the Islands and his counsel and opinions as to the handling of sugar affairs were always listened to with attention and high respect. This Association and the community have sustained a heavy loss in the passing of Mr. Cooke.

In conclusion, gentlemen, I feel that we have much to be thankful for in the past and good reason to look forward hopefully to the future. In an industry such as ours there are naturally many problems coming forward from time to time which need careful study and thought in their solution, but difficulties have been overcome in the past which at the time looked almost insurmountable, and in looking round the members of the Association gathered in this hall I cannot but believe that when the time comes we shall succeed in the future as we have in the past by holding together and each one doing his best in his appointed place. Let us take for our motto, "Fairness and Firmness," and as we give so will it be given to us.

Yours very truly,

S. M. DAMON,
President, Hawaiian Sugar Planters' Association.

November 12th, 1909.

REPORT OF COMMITTEE ON CUTTING, HANDLING, AND GENERAL TRANSPORTATION.

Mr. President, Trustees, and Fellow Members of the H. S. P. A.

The Hawaiian Planters' Record.]

GENTLEMEN:—The subject given this committee to report on is of interest to all of us, namely the cutting, handling, and general transportation of sugar cane on the plantations of Hawaii.

The cutting of cane is a new subject for report, while this is not the case with handling and general transportation. The method of cutting cane on these islands, and I might say the world over, is practically the same as it was thirty years ago. We still use a knife, about 5″ by 14″ by 1/16″, which is made from the best steel. The Disston & Sons cane knife, the one most generally used here, as well as elsewhere, is considered the best.

The proper and expeditious use of the knife, requires an active worker, one who will be careful in handling the same so as to get the best results, both in quantity and in quality from a day's work. Much care is required to cut the cane close to the ground, so as to get all the available sucrose from the cane. This also makes it better for the next crop of ratoons, giving them a good start. On the other hand, if stumps are left sticking up above the ground because of improper cutting, the ratoon crop never gets as good a start, nor does it give good results. The topping of the cane requires judgment in cutting, for if too much is cut off, a loss of sugar is the consequence, while if too little is cut off, the boiling house soon gets into trouble. After the cane is cut and topped, the cutters throw it behind them. On some plantations, it is thrown in any way, while others have it in rows of three, making it easier to lift it, and making it possible for carts and sleds to go between.

Many inventors have worked on machines for the harvesting of sugar cane, but so far no good results have been obtained. It will not be so hard to invent a machine which will cut the cane only, as it will be to invent a machine which will both cut it and top it; for the latter operation requires judgment in operating, as no two sticks of cane are the same length. Furthermore a machine for the cutting of the cane alone, will not be a labor saving device, unless it can cut off the top at the same time of handling. For instance, a man in cutting grasps a stick in one hand, while with the other he cuts it off close to the ground and tops it. Then turning a little he drops it in a row, at right angles to the row being cut. Consequently a harvester which only cuts the cane will not accomplish much of a saving of labor, for it will require not only the men to run the harvester, but also men to follow it, pick up the sticks, top them, and throw them down again, and the cost will be as great as when men alone are employed to cut and top.

THE GINACA MACHINE.

A report on mechanical devices which was read here three years ago, informed us of the fact that a harvester would be working on these islands a few months from that time. Mr. Ginaca, an Island inventor, built a harvester, and had it tried on a certain plantation, but nothing resulted, except a depleted purse, and the machine was laid to one side. Considerable money has been lost on this machine as well as on other harvesters, which have not proved successful.

I do not know if this Association has done anything towards assisting these inventors financially, but I believe that money spent in this way would prove a step in the right direction, for if we expect men to spend time and money working up a machine for us, we should help the good work along, as a harvester which would cut and top the cane, would cause a saving of thousands of men every day, during the harvesting season in these Islands. I see no hope for a harvester, which can be successfully operated on irrigated plantations, until after one to work on unirrigated plantations has been invented, as the cane growing on irrigated plantations has its roots, in the hollows of rows 12″ deep. It is consequently more difficult to cut, and is also a heavier crop, lying in a tangled mass. The unirrigated cane, gows on top of the furrow, furnishing far greater opportunity for mechanical cutting.

DIFFERENCE BETWEEN HAWAII AND LOUISIANA.

It would not be so difficult to cut cane by machinery in Louisiana, where there is only a one year crop, as it would be to do so here; there the cane generally stands erect, while the fields are free from stones, and level as a billiard table, with rows as straight as an arrow, so we may at any time hear of cane being cut successfully by machinery in Louisiana, while it would not necessarily follow that the same machinery would be successful here.

In the matter of the cost of cutting cane on our plantations, and the amount of cane cut by different laborers, I will give what is a fair average, from the reports received from the different managers. For cutting and topping cane by contract, the price runs from 18 to 20 cents per ton of cane, and an average amount of cane for a good cutter to cut, is between 5 and 6 tons of cane a day, though some go as far as 6½ tons. Therefore cane cutters working by contract on our plantations can make from 90 cents up to $1.25 per day, which is considered good wages.

METHODS OF HANDLING CANE.

Handling cane is looked on as one of the hardest jobs on a plantation. To get the cane started on its way to the mill the

first thing after it has been cut, is to have it picked up, and placed on whatever kind of carrier is used on the plantation in question. On some plantations, cane is lifted by hand, and placed on sleds, standing 20″ from the ground, or on trolley cars 30″ high, each additional few inches in height involving a cost of an extra cent or two per ton. Others again pick up cane and carry it a hundred feet or so to a flume, and by this means send it to the mill to be landed on the carrier, or on a car. Some plantations bundle the cane, making it easier to handle, and convenient for weighing. Another method is to place the cane into wagons, on which it is conveyed direct to the mill, or to a cane loader, such as are in use in the Hamakua district, which places the cane onto railroad cars. Still another method, and one which is considered the hardest of all, consists in picking up the cane for a radius of a few hundred feet or so, then carrying the load and placing it on the cars, the men walking a gangway provided for that purpose. On some plantations employing methods similar to this, cane loaders of various kinds have been introduced, but so far they have not been a great success, although cars are filled without the carrying of the cane up the gangway. Some of the unirrigated plantations use loaders for taking the cane off the carts or sleds, and for placing same in the railroad cars, which are ready to go to the mill. These loaders are driven either by gasoline or by steam, or even by mule power, and they have worked very satisfactorily for many years.

Some loaders, or unloaders if you prefer to so call them, are used at the flumes to lift cane off the sleds and place it along side the flumes, in readiness for night work. The labor-saving method is very successful on some of the plantations in the Hilo district, the loader being moved by animal power. Previous to the use of unloaders for the piling of cane up along side the flumes for night work, a number of men were employed to do the work.

In regard to the matter of handling cane, and placing it on sleds, or wagons, by loaders in the fields, as they do in Louisiana, instead of by hand labor, I would state my experience at Waiakea, where we have regular loaders to take our cane off the sleds and place it into railroad cars. As this method works very successfully I thought of using a small loader in the fields to pick up the cane as it is done in Louisiana. It was costing Waiakea ten cents per ton to do all the handling of cane in the fields, and to get the cane into the cars.

It was advertised that in Louisiana the loaders picked up the cane and placed it into carts at a cost of 5 cents per ton, which would mean a saving of 5 cents per ton. I brought one of these loaders to Waiakea two years ago, as I was anxious to save 4 or 5 cents per ton and thus cut the labor bill down. In Louisiana the loader goes into the fields filling the carts, instead of having this done by men, the cane having been placed at right angles into rows, three rows of cane into one and into piles a few feet apart.

No leaves are left in the row where the cane is piled, all that work being done by the cutters, and charged up to cutting cane, instead of to loading, *as we do.* After seeing the loaders at work in Louisiana and comparing them with our work, I saw how they were able to handle cane so much cheaper there than we did.

Another thing in favor of Louisiana's successful lifting by loader, lay in the fact that there the furrows are so deep, that cane lying at right angles to the row, will allow the grab to take hold of the bundle just as a man would clasp his arms about it. This was not the case when I tried it at Waiakea. We do not have the deep furrows which allow the grab to clasp around our cane, the consequence being, that when the grab came together, its points were kept from closing by cane getting between them which continually dribbled out when the grab was lifted. So we had to give it up. Later I tried to use two pieces of 4" by 4" lumber, placing the cane on top of them. Then the grab worked all right, as its points got under the cane and closed tight, but I concluded to give it up because the grab did not close to my entire satisfaction. However, I am now to get from Louisiana one of the latest loaders with a new style of grab, and I hope with this to overcome the chief difficulty which I before encountered, and to be thereby enabled to save a few cents per ton of cane and cut the labor bill down.

In studying the various methods of handling cane, I have come to the conclusion that each plantation is loading and handling the cane as conveniently and as cheaply as circumstances will permit, one finding one way best, and others another. The cost of handling cane on the different plantations, runs all the way up from 10 to 20 cents per ton of cane. I am sure that this difference in cost is not caused by one plantation being more wasteful than another, but it is caused by the fact that the circumstances alter cases.

TRANSPORTATION ON PLANTATIONS.

A great many methods for the transportation of cane from the field to the mill are now in use on these islands. Every island or district has a way of its own, just as the case may be.

The oldest way I know of of transporting cane or any other article on these islands, is by bullock wagons, and in a small way, this method is still to be seen in some quarters, but generally the mules have taken the place of the bullocks and are giving much better results.

FIRST FLUMING.

The second way, and the one which replaced bullocks in the Hilo district, was the V-flume, which was first tried at Onomea by S. L. Austin. It did its work so well that the carting of cane to the mill was discontinued, flumes were erected, and cane

brought easily to the mill. This was one of the most important changes in the manner of transporting cane, and it is the natural way, as the slope of the land is just right, and there is an abundance of water to flume with. When the slope of the land, with plenty of water is to be had for nothing, nothing can excel this way of bringing cane to the mill, in a district where rain is so abundant, and to think of using any other way on the north side of Hilo would be almost impossible.

Transportation from the landings to the fields in the Hilo district, furnishes one of the hardest problems on the islands. You can fancy the work of hauling goods up three or four miles either by wagons or by pack animals, where it rains fifteen inches a month, so that although it is easy to get the cane down to the mill by flume, it is also very hard to get the thousands of tons up the plantation lands by wagons or by pack mules. This is, however, the only feasible method of transportation in this district, and no one knows it better than the men who have this under their charge.

RAILROADS ARE BEST.

For general transportation, nothing excels the railroad, and I think most people agree on that. A railroad works both ways, both in bringing and taking, whereas the flumes work only one way. As far as my memory goes, the Waianae or Kahului railroads were the first built in this country, then came the Waiakea railroad, now thirty years and more at work, and the same three-foot gauge is in use, and is regarded as the best for plantation purposes.

Most of the cane is now brought to the mills by railroad, and this is the most economical method. Irrigated plantations use portable track in their fields, taking it up in sections, and shifting track every 100 or 120 feet. Baldwin locomotives are most generally used, and give good results on the plantation roads. The cars are of all shapes and sizes, although the size most in use is the 4 to 5 ton car.

Transportation on permanent roads on plantations is a somewhat different proposition, as the cane is brought by trolley car or by carts to the main track, and is then reloaded into the railroad cars. In order to get the cane to the main track we have sometimes to haul it a mile or two, and then reload, the reason for this being that the main track cannot be carried any further without much expense, or it may be altogether impracticable to do so, and for the same reason portable track is not used. To use portable track on Waiakea plantation is a matter altogether different from using it on irrigated plantations, where the country is level, is dry, and with no rains. We have rains for a week at a time, and the land is uneven, and to use a portable track would keep us continually in hot water, and very often the mill would be

out of cane. What is a practical method for one place is not so for another.

TRACTION ENGINES IN KOHALA.

In Kohala district, they do their transporting in different ways, but mostly by traction engines, having stake wagons with a capacity of from 4 to 5 tons, which are fitted with short tongues or draw bars, and are hauled by the traction engines to a convenient point in the fields, and thence by mules alongside the cane. When loaded these are hauled to the nearest road, and made up into trains ready for the traction engine on its return from the mill with more cars. This is their most economical method of transportation, but it can be used only during dry weather, it being impossible to move the engine when the conditions are otherwise. When the traction engines cannot work, the same wagons are hauled by mules to the flumes, and emptied into them; three men feeding the same, as in wet weather, the flumes can be used.

TROLLEY WIRES.

The trolley wire provides another system. It consists of a wire stretched from the upper part of a plantation down to the mill, all cane being bundled carefully so as to be handled only once or twice. When the bundles are brought to the wire for transporting they are hooked onto a small trolley attached to the wire, and are then allowed to go. As the grade is considerable, the bundle goes off at a good gait, and before it has gone very far, another bundle is hooked on and follows the first, this being done as fast as possible. On reaching the mill the bundles are caused to tip off the wire and to fall onto a platform, whence they can readily be pushed onto the carrier for milling. The trolley with the rope is carefully taken out from among the cane, and is sent back to the fields to be refilled. The sight of these bundles coming over the fields and gulches, reminds one of flying birds, or aeroplanes. This kind of transportation is found to be the most practical on lands where there is no water for fluming and grade good.

Having enumerated these various ways of transportation, I cannot close without giving an outline of the method used for transporting sugar from the mill to the steamers by means of wire ropes, which is used in the Hilo district.

THE ONOMEA LANDING.

Onomea has one of the worst landings on Hawaii, and was until recently a very expensive place from which to get sugar shipped, on account of high seas at the landing. Hardly a season passed but men lost their lives in an endeavor to get sugar shipped, and time and sugar were lost as well. Since the new apparatus

was placed in working order a fair trial has been given the new way of handling sugar, and so far it has been a great success. The steamer stays in the open sea at a certain distance from the beach, making fast to four buoys as soon as the anchor drops, the vessel being thus kept in one position where it can rise and fall with the waves. When it has been thus secured, a wire rope is made fast over the ship's deck right over the hatchway. This rope is anchored into the sea, and when it has been connected with the shore end, it is pulled tight by the shore end winch. It is then ready for work. About half an hour is consumed in making the steamer fast.

The sugar is placed in slings of eight bags, which is a convenient size to handle, whereas the bags are often cut by the ropes when a greater number of bags are placed in a sling. However, to make up a full load to send to the steamer, no less than eight of these slings are hooked onto the wire at one time, and a total of 64 bags are thus taken to the steamer and placed in the hold at the same time. provided the hatches are large enough. The average tonnage shipped per hour, varies from 90 to 100 tons, and the best work which has been done, was the sending of 109 tons, or 1,750 bags, in one hour, using 25 men working the cars and slinging the sugar.

The greatest benefit of all, says Mr. Moir, is the fact that the plantation can ship at all times when the steamer is able to hook on, and so far, rough weather has not interfered.

COST OF LOADING.

The cost of taking the sugar from the sugar room, and landing it on board the steamer, amounts to .086 cents per ton of sugar, or $8.60 per 100 tons. On the windward side of Hawaii, no less than ten of these wire rope landings will be in use this coming season, for the transportation of all kinds of goods, to and from the landings.

In the matter of making comparisons between the different plantations, in the various districts, it is hard to do justice, as one place is naturally adapted to fluming, another to the wire rope system, still another to carting, and so on. However, I can show that on the plantations, railroads provide the cheapest method of transporting cane, or any other kind of goods. Fluming is the easiest way where the land has sufficient slope, and there is plenty of water, but,—pardon me if I say it—fluming is the most expensive way of transporting cane if we may rely on the figures of those who use the fluming system. The wire rope is next in expense, according to these reports.

RELATIVE COST OF DIFFERENT METHODS OF TRANSPORTING CANE.

Now, in the matter of the cost of harvesting cane on these islands by the various methods,—taking into consideration the cutting, handling, and transporting, the following figures represent the nearest information to hand:

Where fluming is strictly used; per ton of sugar	$6.25
Wire rope and trolley, per ton of sugar	6.00
Traction engine and flume, per ton of sugar	5.94
Carts and flumes, per ton of sugar	5.90
Railroad and wagons, per ton of sugar	5.50
Permanent railroads and sleds, per ton of sugar	4.52
Movable railroad, per ton of sugar	4.00

C. C. KENNEDY,
WM W. GOODALE.

SUPPLEMENTARY REPORT OF MR. W. W. GOODALE.

Waialua, November 4, 1909.

Mr. C. C. Kennedy, Chairman,
Committee on Cutting, Loading & General Transportation,
H. S. P. A., Honolulu.

DEAR SIR:—I have little to add to what is already known on this subject.

All cutting and loading where railroad cars and portable track are used, has been at the same rates on this plantation for the last four years, viz:

16½¢ per ton for cutting,
17½¢ " " " loading,
5½¢ " " " laying portable track on smooth fields,
6¢ " " " " " " where fields are narrow and grades are steep.

At these rates, all the men as a rule, earn wages in excess of the highest rates paid for day work.

The portable tracks are laid 160 feet apart, so that the loaders pack the cane not to exceed 80 feet. Nearly all our loaders are married men, and their wives work with them in the field; the women gathering the cane in bundles and the men carrying it to and placing it in the cars.

It has been customary on this plantation to strip all the cane carefully twice during its growth, one stripping being after the tasseling season.

During the latter part of the grinding season the cane becomes badly lodged and matted with the dry leaves, and especially during the warm months of the year, from May on, cutting cane is very disagreeable, owing to the heat in the cane fields, and the men do not accomplish as much as during the earlier months of the year. During this last season we adopted the plan of burning off the cane ahead of the cutters. This makes the cutting much easier and in fact makes it possible for the cutters, loaders and portable track men to do much more work in a day, and reduces the ex-

pense of clearing the fields and picking up the scattered and uncut cane.

About a year ago a man came to Honolulu from one of the middle States, bringing with him drawings of a proposed cane cutting and harvesting machine. The inventor stated that the machine had been built and was ready for shipment. The drawings showed that it was heavy, complicated, cumbersome and in every way impracticable for use in cane fields in Hawaii. He was told this, but to satisfy himself he visited one of the plantations on Oahu and saw the cane cutting in operation. He returned to the coast by the first steamer and I have heard nothing more from him.

About three years ago a member of a firm in the United States that manufactures hoisting machinery of all kinds, brought out from the East a complete outfit for loading cane, and installed it in one of the Waialua fields; he took a contract for loading cane at the same rate as the contract laborers, his profit to be the difference between what it would cost him to load the cane by machinery and what the same cane would have cost us if loaded by contract at the rate of that year, viz., 17½¢ per ton for loading and 5½¢ per ton for portable track work.

I send you with this a picture showing two-thirds of the outfit. It consisted of a central tower 60 feet high, carrying two complete hoisting engines; two outer towers, each carrying an outer end of the main cable, the endless traveling rope and the button rope; the end towers standing about 700 feet each from the central tower.

The outfit was intended to operate in this way:

The towers to be set in line and covering a strip of about 1400 feet in width; portable tracks were to be laid, one on each side of the central tower; the cane to be picked up, placed in chain slings, each sling load to weigh from two to three tons, (more, if possible, so that each sling load might be sufficient for one car load) the sling loads to be lifted by the hoisting rope operated from the central tower, drawn in with a trolley and placed in the cars; the towers were placed on rollers running on 6"x16" timbers placed on the ground and blocked sufficiently to make a firm roadway.

This outfit was manufactured by the Lidgerwood Cable Co. and was a modification of the system used on the Chicago Drainage Canal and other works of that kind, and the same that I put in at Papaikou Landing in 1894. It is first-class machinery of its kind and is successfully used where the towers are permanently located or where it is necessary to move them short distances only and at long intervals. In the cane field it was a failure.

I have no means of telling just what it cost the contractor to load the cane, but I know it was much in excess of the prices paid by us for work performed in the old way.

It was necessary to move the outfit about once in 50 or 60 feet, so that it would clear with each moving, about two acres of

land; the towers, ropes and engines weighed about 100 tons. One of the weak points in the system was that every time 100 tons of cane were loaded and placed on cars, it was necessary to move an equal weight of towers and ropes, for which there was no pay. I estimate that the cost of moving the 100-ton outfit was greater than the cost of loading 100 tons of cane.

The amount of money locked up in this plant was very great, probably not less than $30,000.00.

After several weeks of hard work the contractor discontinued work, shipped part of the outfit back to the coast and sold the remainder. He had good courage, however, and tried another experiment the following year. This time the apparatus consisted of a logging engine or a portable derrick, revolving on a base mounted on small wheels. The derrick, boiler, engine and truck weighed 22 tons. It was intended to run on a portable track alongside of the portable tracks as used in the fields; the cane to be placed in chain slings, dragged in from a distance of from 50 to 400 feet, and placed in cars on the portable track.

This was an expensive outfit, the exact cost of which I do not know, but its cost, its weight and the labor of gathering the cane, placing it in slings and stowing it in cars, far exceeded the cost of doing the work by contract at the rates paid. Besides this disadvantage there was a loss to the plantation because of the cane being broken and bruised in handling, and the heavy sling loads while being dragged in over the fields, did much damage to the furrows in irrigated fields, filling them up and obliterating the water courses, and trash and earth were scraped into large piles. This made it difficult to burn and clean the fields, and required a great deal of hand labor after burning to put the fields in shape for irrigation.

As a part of this system, the contractor erected at the mill a steel swinging derrick with a 60-foot boom, for taking the cane out of the cars in slings and placing it upon the cane carrier. This was not a success here, where it would not do as much work or as well as the Gregg and Wicke's cane unloaders, although the system is said to work well in Louisiana and other sugar countries, and advertisements of similar derricks are to be found in the Louisiana Planter and other sugar journals.

The plantation did everything possible to assist the contractor. We put up with much inconvenience and loss of time in the field and at the mill.

After about six weeks the contractor gave it up and the machinery was dismantled; the derrick at the mill was shipped to Peru and erected at a plantation, and the derrick used in the field is now in use on the Hilo Breakwater. Any one who has seen it can appreciate its unfitness for work in the cane field.

I am sorry that we have no picture showing the portable derrick in use in the field or at the mill.

So far, the experiments tried in loading cane by machinery,

show that while they will load cane they cannot do it in all fields and under all conditions for less than it costs us by contract at present rates.

Should it become necessary to pay more for doing the work by contract, it is probable that money might be saved by using the Wilson & Webster cane loader. I think it is true that your machine would do the same, but as I have never seen it work I cannot speak from my own experience.

At Waialua, on some of our upper fields, we are using flumes instead of portable track, the cane being flumed directly into the cars on the main line. This is still something of an experiment, but I think there is much to be said in its favor.

Regretting that I can contribute nothing of value to your report, I am

Yours truly,

W. W. GOODALE,
Manager, Waialua Agricultural Co., Ltd.

REPORT OF COMMITTEE ON CULTIVATION, FERTILIZATION, AND IRRIGATION ON IRRIGATED PLANTATIONS.

The Hawaiian Planters' Record.]

Honolulu, Oahu, T. H., Nov. 6, 1909.

To the President and Members of the Hawaiian Sugar Planters' Association.

GENTLEMEN:—The following report on "Cultivation, Fertilization, and Irrigation on Irrigated Plantations," is respectfully submitted.

Cultivation.

In a way there is little to be added on this subject to what has already been taken up in the reports of previous years. The preparation of the soil, the planting of the seed, and the details of ordinary cultivation, varied to suit the necessities of each locality, are so well understood by the members of this Association that it would be superfluous to write of them.

There are, however, several things which might be brought to your attention concerning which there has been considerable interest and discussion during the past two years. More particularly, these are as follows: The stripping of cane; hilling-up of ratoons; the importance of raising either seedlings or other varieties of cane on irrigated plantations to take the place of Lahaina and other standard canes, should the necessity eventually arise; and, lastly, the question of soil recuperation.

In the matter of stripping, the tests made at the Experiment Station in Honolulu, together with the experience of a majority of plantations on Kauai, Maui and Oahu, seem to have settled as a fact on irrigated estates in the warmer and dryer belts that stripping cane is not only an unnecessary expense, but that it is detrimental to the sugar cane itself. It is believed that if a vote were taken on this question by the various managers, the result would show a preponderance very largely in favor of not stripping.

Apart from the falling off in yield through stripping the economic aspects of the case are important. Stripping is costly. The elimination of this expense is not only desirable in itself, but the elimination of the men from this task for other and absolutely necessary work is, when labor is not too plentiful, very devoutly to be wished.

Again, the growing disposition of some plantations to burn their cane fields in sections before harvesting renders stripping, in those cases, unnecessary from the point of view of reduced cutting expense. With stripped cane there is less danger of damage from fire, because a fire will proceed less rapidly in stripped cane than in unstripped. But it is not probable that this slightly greater risk can offset to any degree the marked advantages in other respects of not stripping, and, especially, where sections for a day's run are burnt off immediately prior to harvesting. Some stripping, however, must be done. It is still considered necessary to strip margins of fields as a preventive against accidental fires and also to strip canes along water courses and larger ditches, to facilitate the work of irrigation. But this does not militate against the proposition of dropping general stripping altogether.

Confirming the above statements, Mr. E. H. W. Broadbent, Manager of Grove Farm, writes as follows:

"We have practically dropped stripping. All that is now done is along railroad tracks and roadways as a precaution against fire, and along water courses, which is done by the watering men. We find that with Caledonia cane about the only gain from stripping is that we get more cane cut per man, but not enough to pay for the stripping. The difference in the juices from stripped and unstripped fields was practically none, nor was the amount of dead canes any greater in unstripped fields than in fields that were stripped, notwithstanding the fact that this is a district in which cane borer is very numerous."

Hilling-Up Ratoon Cane.

This is steadily working its way into favor. Those estates which have adopted it as a regular system still hold to it as the best method of ratoon cultivation, and those who have experimented with it speak highly of it.

On the Island of Oahu, where several years ago but one plantation made a regular practice of it, it is now growing more in use,

though not so general, yet, as on Maui or Kauai. On this subject Mr. Broadbent says:

"Our practice is to hill-up all ratoons. We use for that purpose the Benicia-Horner Disc Cultivator. In hilling-up first ratoons we first apply 800 to 1000 pounds of complete fertilizer, which is put on by drills, which apply the fertilizer on both sides of the row of cane, and are drawn by two mules. Behind these machines come the cultivators drawn by three mules abreast, and set deep enough to split the furrows and throw enough earth into the cane to cover up the fertilizer, and also make furrow enough to be able to irrigate between the rows of cane. After we have gone round all the ratoons in this manner, we go through a second time with two mules tandem to each cultivator, and hill-up a little more, also getting rid of young weeds that have started.

"With second ratoons we run a small plow close up to the cane on both sides of the row, throwing the earth away from the cane, which leaves a small furrow in which the fertilizer is dropped, then the cultivation is the same as with first ratoons.

"The cultivators are kept going till the cane is too big to get through without danger of damage. After each cultivation the water courses and level ditches are opened up with suitable plows, and, with a very little hand labor, the field is in shape for irrigation."

Mr. H. B. Penhallow, Manager of the Wailuku Plantation, on Maui, who has just begun to hill-up, gives his opinion of this practice in the following favorable terms:

"Last November * * * two small fields, the poorest pieces we had in ratoons, were hilled-up with rice plows—the only plows that were available—but even this crude work was of such marked benefit to the cane that we had cultivators and plows made on the Puunene pattern, and have hilled-up all the ratoons for the 1911 crop. We found that cane hilled-up as late as September and then cut back has quite caught up to the cane we cut back at the usual time (July), which was hilled up afterwards. However, as this is only one trial, whatever is apparent this time may not hold true."

When a manager, after trying two small fields, hills up his entire ratoon area for the following crop, before testing his returns, it speaks well for his opinion of its desirability, although he was influenced chiefly by the practice of the neighboring plantations.

The benefits from hilling-up may be very briefly stated: (1st) The plows loosen up the soil around the stools so that the newly formed roots can more easily penetrate it and thus the young canes obtain a better start; (2nd) it reduces the cost of weeding; (3rd) it enables ratooning to be carried on longer with advantage, especially if the furrows are shallow.

Perhaps it might be well for our Experiment Station to make a

test of hilling-up ratoons and thus, in a measure, set at rest the question of its efficiency for general practice.

Cane Varieties.

The raising of Hawaiian seedlings and other varieties of previously imported canes on every plantation, so as to enable us by thorough test to compare them with our standard Lahaina, is something the importance of which cannot be overestimated. It is now being done by all of us. What it is wished to emphasize, in this brief allusion to this subject, is the importance of growing a sufficient quantity of, and of testing, the most promising of these varieties on fairly large areas, in various locations on each plantation. The reason for this is that not always can sufficiently definite results be obtained on a small experimental plot, which merely indicates the preëminence of certain varieties on that particular location or plot. As a matter of fact, a number of plantations contain several different soils within their boundaries, and, unless experiment stations are conducted on each of these different soils, results are apt to be misleading. For instance, on the makai adobe soils, 60 foot elevation, at Ewa plantation, the plant cane harvested in 1907 ran about thus in yield: Lahaina, first; Yellow Caledonia, a close second; and Demerara No. 117, a poor third. In the ratoons ground in 1909 from the same plots, Yellow Caledonia and Lahaina yielded approximately the same, followed by Demerara 117, in the same relative position as before. In contrast to this, the plant cane taken off in 1908 on red soils at 200 foot elevation, the results were: Demerara No. 117 first, with Yellow Caledonia and Lahaina following as close seconds. How the Demerara 117 ratoons will turn out as ratoons for 1910 has yet to be determined.

Any tests made at the Experiment Station at Honolulu are only comparable with plantations with like soil and general climatic conditions. For this reason sub-stations on different plantations were located, and valuable information is now being obtained from them. For this reason, also, cane varieties are being distributed from the Station so that sugar estates may work out experiments to suit their local conditions. At the same time while these experiments are being carried out on test plots, it is wished to emphasize again the importance of carrying on also, as before stated, fairly good-sized areas of the different and best varieties on what may be termed "a plantation scale," and over a number of years and on different parts of each plantation. Hitherto all the irrigated places have pinned their faith principally to "Lahaina." It is a splendid cane, with magnificent ratooning qualities. Perhaps, however, the time may come when diseases or insect enemies may sap its strength. And if this should happen, it would be well for us to be prepard to substitute another variety or other varieties which have been found by test to be

suitable, and from these fairly good-sized areas before referred to, obtain sufficient seed canes with which to effect the change in the shortest space of time.

It is an old saying that "Sugar is made in the field." Certain it is that the condition of our fields is of prime importance.

As planters we are engaged in raising seedlings of various sorts, searching for the best to suit our needs. We till well, we cultivate well, we fertilize and irrigate liberally, and we are getting good crops. But we are practically cropping the same crop (sugar cane) all the time, and, as a rule, we do not rest our lands, nor rotate crops. Agricultural experts tell us that the continuous cropping of the same plant is productive of disease and consequent reduction of yield. What are we going to do about it?

The need of doing something may not be apparent at present, for very large areas on irrigated estates have not been cultivated more than ten years or thereabouts. These may be considered comparatively new lands. It is very likely that, taken acre by acre, we are about at the zenith of our productiveness in sugar yields. How shall we keep it there?

On plantations where the rainfall is sufficient for growing a leguminous crop, the question can easily be solved. But for those places where the rainfall is insufficient for this purpose, can any one tell us of a cheap way to conserve the soil? Pumping artesian water to irrigate legumes would be costly, but it may be necessary. In the end, something will have to be done, even if only to let the land lie fallow.

We should find out if there are any plants suitable for the purpose which could be grown in some of our dryer belts, which would require very little water, and, if so, what they are and where they are.

In the July issue of "The Hawaiian Planters' Record," the Experiment Station organ, there is on page 17, the following statement, very modestly stated and yet pregnant with truth:

"The great importance of 'resting' fields in rotation on Hawaiian plantations, and growing upon them leguminous crops is very clearly indicated. This applies more particularly to the irrigated plantations, where the supplies of organic matter are in the majority of cases becoming greatly reduced through successive tillage operations in a comparatively arid climate, and by the favorable conditions created for bacterial activity through regular irrigation under uniformly high temperatures."

Fertilization.

With the data at hand this can only be very briefly referred to. Climatic conditions differ; soils differ; no committee can say what should be done or how it should be done for these varying conditions, and each locality should govern itself accordingly.

Nevertheless, there is one thing that stands out prominently in fertilizing our cane fields and which is generally applicable to all places. It is the value of ammonia as a sugar producer, and those plantations which have made liberal applications of this element in the past may not only have the gratification of knowing that they have derived great financial benefit from its use, but that the correctness of their judgment has been corroborated by tests made at the Experiment Station.

It is considered the best practice, when applying ammonia as nitrate of soda, to do so in small doses. On the Ewa and Oahu plantations, on Oahu, and also on other estates this is applied in solution in the irrigation water and is a very efficient and economical form of application. Generally, the amount applied runs about 100 pounds and sometimes 150 pounds per acre for each application.

Irrigation.

The main thing is to see that the cane gets enough of it during the warm growing months. Perhaps it is safe to say that with hardly an exception no irrigated plantation has enough water during the months, from June to the end of August or September, when the crop of the coming season is making its greatest growth and the young plant or ratoons are being started. It is then that the plantations are taxing their pumping systems to their greatest capacity, and when mountain streams are apt to run low.

A number of years ago Dr. Maxwell found the most profitable application of water to be two inches per week. His successor, Mr. Blouin, in his tests discovered that three inches per week was still more profitable. This was done without considering the cost of the water applied. Later still, Dr. Eckart made some very interesting comments on these previous tests.

The points which it is intended to bring out from these references are:

(1st.) That for those plantations who derive their supply from mountain streams which frequently run low in summer when their supply is most needed, we should know not only the most profitable amount, but the maximum efficiency of a given quantity of water, so as to distribute that given quantity to both young and old canes in the most profitable manner; in short, so as to make the most sugar.

(2nd.) For those plantations which depend upon systems of artesian wells for their supply, where every 1,000,000 gallons pumped represents a different outlay for varying elevations, the maximum efficiency bears a very definite relation to the height pumped and its consequent cost. More especially should it be thoroughly understood and made use of on artesian systems where there is any question of an overdraught on the artesion supply. To illustrate the point regarding expenditure for varying elevations to which water is pumped, the Ewa Plantation Co.

spent in 1907, including operating expenses and repairs to pumps, a trifle less than 5½ cents to lift 1,000,000 gallons of water one foot. The average height pumped during that year was 108 feet. If to the above expenses were added interest at 7% on cost of plant, ditches, reservoirs, pipe lines, etc., the expense would be increased to 8 cents.

It is safe to say that if elevating 1,000,000 gallons one foot costs 8 cents, then

elevating to	100	feet	would	cost			$ 8.00	per	million	gallons
"	" 200	"	"	"	at	least	16.00	"	"	"
"	" 300	"	"	"	"	"	24.00	"	"	"

It is evident, therefore, that at the higher elevations it becomes rather a nice question to determine the most profitable amount to apply to the land. This is, of course, leaving out of the question the saline ingredients of the irrigation water.

One thing, at least, should be determined in any shortage of water, viz., whether it is more profitable to water young cane, a few months old, at the expense of older cane, a year old, or vice versa. We know that young cane can appropriate much less water than older cane, and that with a fairly good irrigation much more growth of stalk can be obtained from cane a year old than from that which has only a few months' growth. The pros and cons of this have been discussed during the past few years. Perhaps it should be discussed again. We should be able, within reasonable limits, to determine what to do as these contingencies arise.

Burning Cane Before Cutting.

Before concluding it may be well to speak of the practice of burning before cutting. Mention of this has been made before. On those estates where it has been tried, sections large enough for a day's run at the mill are burnt the evening before cutting. The practice is certainly growing. It has these advantages:

(1) The cutting and loading is much more easily and consequently more cheaply done.

(2) The ratoons start quicker and stronger.

(3) A large number of borers and borer beetles are destroyed.

(4) Portable track work is rendered easier.

The disadvantages are these:

(1) A certain amount of damage is done to the cane in burning.

(2) If the burnt cane is not handled rapidly, there is danger of great loss in weight and deterioration of juice.

At Ewa, Waialua and Kahuku plantations burning before cutting was carried on during the latter portion of the 1909 crop. It is said to be in favor on some Maui plantations. Taking everything into consideration these Oahu estates have decided during 1910 to again test the practice. It is very likely that this decision

is based to a great extent on the economic factor of reduced labor required for this specific class of work.

Not long ago a small experiment was conducted on the Ewa plantation to determine the loss in weight of cane and fall in purity of juice through burning, in sections, immediately before cutting. The results were as follows:

LOSS IN WEIGHT OF CANE.

	After Burning.	After 24 hours.	After 48 hours.	After 72 hours.	After 96 hours.
Cane not burned.....		1.75%	2.82%	5.33%	6.36%
Cane burned, 2 lots averaged 3.57%		4.12%	6.12%	8.12%	10.03%

FALL IN PURITY OF JUICE.

	After Burning.	After 24 hours.	After 48 hours.	After 72 hours.	After 96 hours.
Cane not burned.....77.6%		4.2%	6.6%	4.2%	5.3%
Cane burned, 2 lots averaged 85.6%		1.7%	1.9%	2.4%	6.4%

The above is not considered an exhaustive experiment. And tests will again be made next year. It will be noticed that, in the fall of purity of juice of cane not burned, the purity apparently showed better after 72 hours than it did after 48 hours. This is explained by the fact that in the determination for purity probably better stalks of cane were selected from the test car on the third day than on the second. As these stalks were destroyed in the analysis, other stalks had to be taken on successive days. In the cane burned the averages of two lots were taken. They show a fairly regular fall in weight and a very rapid drop in purity after forty-eight hours. The question of where the loss in weight is taken from is perplexing. It is not determined yet whether it is a loss in mere moisture, or whether it is a loss in the general constituents of the cane stalk. Probably tests made next season by those plantations which may test the practice of burning will throw more light on the subject. We already know that, in this climate, the sooner cane is ground after cutting, the better. And this fact is further emphasized by the above figures, wherever burning before cutting may be attempted.

Unless tests have been made by different estates to suit particular conditions of soil and climate and the figures submitted a report on cultivation with its various branches must, of necessity, deal with the subject in general terms. Unfortunately this committee has no figures to submit, and this paper is written more for the purpose of bringing out a discussion of the points brought forward, knowing that the interchange of ideas and experience of different members will of itself be of great benefit to us all.

Respectfully submitted,

GEO. F. RENTON,

Chairman of Committee on Cultivation, Fertilization and Irrigation on Irrigated Plantations.

H. B. PENHALLOW.

SUPPLEMENTARY REPORT BY MR. H. P. BALDWIN WITH REFERENCE TO STRIPPING TESTS AT PUUNENE.

Most of the cane stripping experiments by the Experiment Station the last two years on various Hawaiian plantations, and all experiments along this line conducted by the Hawaiian Commercial & Sugar Company's plantation seem to demonstrate pretty clearly that it does not pay to strip cane in several localities on the islands.

To my mind it is a question of temperature. The temperature of the cane itself unquestionably affects the sucrose content and the purity of the juice in the cane, and indications I observed last year led me to the conclusion that the temperature of the cane itself was more uniform in cane that had not been stripped, than in cane that had been stripped—that while it is necessary to have a very warm atmospheric temperature to obtain cane very rich in sucrose, it is necessary that there should be as little disturbance in the temperature as possible, especially while the cane is ripening, in order to obtain the best results. In other words that the temperature should be as uniform as possible.

In order to test this question I made a series of tests at Puunene this last milling season, selecting a field adjoining the sugar factory for making the tests, within easy reach of the chemist; moreover the field selected was admirably located for the proposed tests, as it was extremely warm in that locality during the day time, and a cool land breeze straight from the Haleakala Mountain, 10,000 feet high, made it quite cool at night, so that there was quite a difference between the maximum and minimum temperature each day.

A suitable section of the field for making the test was selected, and every other strip of cane running between irrigation ditches that were 30 feet apart, were stripped two months before the tests were made. The alternate strips of cane were not stripped.

I give herewith the results of the tests made, also the average atmospheric temperature for each of the five months during which the tests were made.

A chemical thermometer was used in making all temperature tests of the cane. A hole was cut in the cane and the thermometer inserted in this hole.

SUMMARY OF STRIPPED VS. UNSTRIPPED CANE FOR 1909; JANUARY TO MAY INCLUSIVE.

STRIPPED CANE.

Date.	Brix.	Sucrose.	Purity.	Temp. Degrees F. @ 5 A. M.	3 P. M.
January 5th.....	18.90	17.48	92.49	58.7	72.5
" 19th.....	20.24	19.20	94.86	61.7	77.7
Average	19.57	18.34	93.71	60.2	75.1
Variation in Temperature.....				14.9	
February 3rd.....	19.88	18.75	94.31	63.4	72.9
" 16th.....	20.33	19.18	94.34	64.8	72.4
Average	20.11	18.97	94.33	64.1	72.6
Variation in Temperature.....				8.5	
March 2nd.....	20.52	19.42	94.64	64.6	71.2
" 16th.....	19.66	18.40	93.59	66.4	72.7
Average	20.09	18.91	94.13	65.5	72.0
Variation in Temperature.....				6.5	
April 2nd.....	19.77	18.25	92.31	66.1	72.1
" 16th.....	20.55	19.18	93.33	64.0	72.4
Average	20.16	18.71	92.81	65.0	72.2
Variation in Temperature.....				7.2	
May 5th.....	21.33	19.57	91.75	67.9	77.3
" 21st.....	21.00	18.97	90.33	69.4	80.4
Average	21.16	19.27	91.07	68.6	78.8
Variation in Temperature.....				10.2	

UNSTRIPPED CANE.

Date.	Brix.	Sucrose.	Purity.	Temp. Degrees F. @ 5 A. M.	3 P. M.
January 5th	20.11	18.85	93.75	60.3	68.7
" 19th	19.57	18.67	95.40	63.4	72.5
Average	19.84	18.76	94.56	61.9	70.6
Variation in Temperature				8.7	
February 3rd	20.75	19.70	94.94	63.0	71.0
" 16th	20.52	19.68	95.91	63.8	69.0
Average	20.63	19.69	95.44	63.4	70.0
Variation in Temperature				6.6	
March 2nd	21.35	20.38	95.46	64.7	71.5
" 16th	20.52	19.07	92.93	66.4	71.2
Average	20.94	19.72	94.22	65.6	71.4
Variation in Temperature				5.8	
April 2nd	20.87	19.63	94.06	66.3	70.2
" 16th	21.08	19.67	93.31	64.4	71.4
Average	20.98	19.65	93.66	65.3	70.8
Variation in Temperature				5.5	
May 5th	21.90	20.23	92.37	69.2	72.9
" 21st	22.20	20.57	92.66	69.1	77.5
Average	22.05	20.40	92.52	69.2	75.2
Variation in Temperature				6.0	

AVERAGE FOR SEASON.

Stripped	20.22	18.84	93.18	64.7	74.1
Unstripped	20.89	19.64	94.02	65.1	71.6

AVERAGE VARIATION IN TEMPERATURE.

Stripped	9.4
Unstripped	6.5

AVERAGE TEMPERATURE AT PUUNENE DURING THE FIVE MONTHS THE TESTS WERE MADE.

1909.	High.	Low.	Average.
January	86	54	70
February	86	54	69
March	84	57	69
April	86	58	72
May	85	60	72

It will be observed that the average variation in temperature of the stripped cane for the five months was 9.4, while the average temperature of the unstripped cane for the five months was only 6.5.

While the above experiment does not prove that the more uniform temperature in the unstripped cane was the principal reason why the unstripped cane was richer in sucrose than the stripped cane, yet to my mind that is the rational and natural conclusion.

There are probably but few localities on the islands where it is at all necessary or profitable to strip cane, and it appears to be certain that it is not only a loss in sugar, but a loss in labor to strip cane in all localities where there is a considerable difference between the maximum and minimum temperature.

I think that further experiments on the above lines should be made by the Expeiment Station. It may be that removing the dry leaves of the cane, the covering that nature has provided to protect the cane from the elements, injures to some extent the growth of the cane. The whole question should be investigated still further.

Respectfully submitted,

(Signed) H. P. BALDWIN.

November 15, 1909.

REPORT OF THE COMMITTEE ON CULTIVATION AND FERTILIZATION ON UNIRRIGATED PLANTATIONS.

The Hawaiian Planters' Record.]

To the President and Members of the Hawaiian Sugar Planters' Association.

GENTLEMEN:—This has perhaps been the subject of many reports, extending back to earlier meetings of this Association, and it is difficult to find new matter of interest to embody in this paper.

I am interested in the following phase of the subject, namely: Do weedy or grassy fields in the earlier stages of the cane's growth, reduce the yield, or increase it, or is this condition neutral in the ultimate yield or result in sugar per acre? In other words, how far can we green soil to advantage before the cane plant roots begin to take possession of the space we allow for them?

I think you all can recall to mind some particular field or fields, that during early growth were very foul with weeds and which on being cleaned up before the young cane had changed its healthy color to yellow, at once put on rapid and vigorous growth, and

whose yield in tons of cane exceeded that of fields that had been kept free from weeds from the time of planting.

One of the old-time customs in the early seventies was that of burying the weeds alongside the young plant cane. To explain this more fully, it may be well to mention that labor at that time was almost entirely confined to native Hawaiians and a few Chinese, both of which nationalities were under contracts. Owing to this condition of the labor market, it was very difficult for any plantation to increase its working force. Animals were almost entirely limited to working oxen and Hawaiian pack mules, so that very little work was performed in the fields with animals in the way of cultivation of the young cane. Success or failure depended upon the ability of each individual proprietor to deal with his fields mainly by means of the hoe gang.

This condition existing, the fields became very weedy, necessitating frequent hoeings and high piling up of the weeds between the rows, it being at times almost impossible to walk along the space between the rows—best described by the native word "kuakua." As soon as the young cane was far enough advanced to admit of it, this mass of half-rotted and half-growing vegetation was drawn into the row below from the kuakua mauka of it and covered with a light coating of earth, the whole sometimes rising as high on the young cane plants as the point where the leaves separate from the stalks. In a few days time, this mass of vegetable matter would shrink to half its original bulk. Care was taken in drawing this mass into the row, to turn the green underneath, and the partially rotted bottom of the triangular heap to the top, thus effectually placing all green growth so far underground as to prevent any further growth from it.

Fields so treated soon began to grow rapidly, and many of the heavy yields of those times may be attributed to this method of green soiling, as commercial fertilizers were rarely used.

Now, the point I wish to make clear is, that young cane, in its early stages of growth, does not and can not make use of more than a very small portion of the 5′ or 5′ 6″ of surface soil placed at its disposal, and the question is, cannot this area be used to better advantage in raising future food for the cane plant than by keeping it bare? Nature in a great many instances does make a good use of it by covering it with a crop of weeds, whose root system ultimately becomes plant food for the young cane.

In some of the older cane countries, crops are grown in the kuakua and turned under along side of the cane row when at the right stage of growth to be of the most benefit to the young cane plants.

It is no doubt a fact, that the weeds get some of the nitrates furnished with the seed cane, but as there is generally more of this than the young cane can immediately use, it is probable that as much ultimately reaches the young cane roots, as if left to leach

away in the soil, as the weeds and their root systems soon become plant food.

Perhaps a recent argument in support of this theory is the large yield from the plant of 1906, harvested in 1908. The first mentioned year was a very difficult one for labor on the island of Hawaii, and I think that the fields of young cane were unusually grassy during their early growth, but yielded a heavy crop when matured. Of course this may have been largely due to other causes.

I suggest that our Station start some tests with this point in view.

Green Soiling With Lupines.—During the month of October, 1905, the Hamakua Mill Co. sowed a 300-acre field with these seeds. The weather proving favorable they attained a very heavy growth, allowing of the plowing in of a thick mat of plants during the following April. I applied fertilizers to this field of cane, nitrogen being withheld, and potash and phosphate being supplied in the usual quantities, at the usual time. At the same time the adjoining fields received a complete fertilizer, containing 10% of ammonia. The saving in nitrogen amounted to $11.74 per acre on the green soiled field, and its yield exceeded by over one ton the yield from the adjoining field of plant cane, the yield in tons of sugar being over 6 tons.

Stable Manure.—From year to year greater care is being taken of this, and very few estates now allow their heaps to remain unprotected from the weather, while quite a few plantations keep sheep, cattle or mules on their heaps at night, in order to compact them, which is a great help in preventing heating and the consequent burning up of the nitrogen. It is possible with good care of stable manure to make its value equal at least 40% of the cost of the feed fed to the stock.

Improved Implements.—Each year sees a marked advance in the use of labor-saving implements, among which may be mentioned the Manure Spreader and the Lime Spreader, while there is a constant advance in the use of improved disc implements.

I beg to submit herewith letters from Mr. J. T. Moir and Mr. John Hind, members of this Committee, written in response to a request for their opinions on the subject of weedy fields. Also a letter from Mr. W. P. Naquin, Field Chemist at Olaa Sugar Company.

Respectfully submitted,

(Signed) A. LIDGATE,
Chairman Committee on Cultivation and Fertilization on Unirrigated Plantations.

SUPPLEMENTARY LETTER BY MR. JOHN T. MOIR.

Papaikou, Hawaii, Oct. 25, 1909.

A. Lidgate, Esq.,
Chairman, Committee on Cultivation and Fertilization,
Paauilo, Hawaii.

DEAR SIR:—Your favor of 19th inst. to hand, asking any help I may be able to give you in making up your report. I would say in reply that I have rather hurriedly prepared some notes which, although not new perhaps, may be of interest, and I hope will be of some use to you.

Fertilization and Cultivation, Unirrigated.—The practice on the plantation of the Onomea Sugar Co. is as follows: On land that is to be plowed up and planted, after the crop of ratoons is taken off and what clearing is necessary done, we put in our Stubble Buster plow, which shatters the whole stools; then harrow down level, and immediately start in to round plow either with the Secretary Disc plow, or the "Moline" Sulky, known as the Flying Dutchman. After thorough plowing, it is again harrowed until we get a good mold; then it is furrowed out by a furrow plow on wheels (home made); then fertilizer or tankage is applied in the bottom of the furrow, and that is followed up by a subsoiler composed of three grubber tines attached to a plow beam, which subsoils thoroughly and also mixes well the fertilizer with the soil. We then plant the cane in the mixed soil by just pushing it in, having it covered by about one inch of dirt. Of course, this varies somewhat according to the weather. If the soil is very dry and loose, we put on from an inch and a half to two inches.

Before hoeing the first time, we generally run a double disc cultivator (home made) astraddle of the kokoa and turn into center and away from the cane, leaving only a small piece to hoe. This double disc cultivator is capable of being used for a great many purposes by changing the angle of discs for throwing out or in as wanted.

After hoeing first time we generally apply a 400-lb. dose of High Grade (consisting of 6-7% Phosphoric Acid from bone meal, 12% Sulphate of Potash, actual, and 11-12% Sulphate of Ammonia and Organic), and cover it generally with the three tined subsoiler before mentioned, which now has attached to it a small bar set at an angle to push the dirt over the fertilizer at the same time as the three tines are loosening up the soil 6 to 8 inches away from the young cane or plant cane.

The foregoing all applies to plant; the rest of the cultivating given consists in using the "Horner" cultivator, if weedy, and the Planet Jr. double disc and small plow according to requirements, the aim being to give it all possible stirring up in the center of the space between the rows of cane, until it closes us out. The upper fields we hill up more than the lower, but neither very high unless in the case of a very wet field.

The treatment we give the ratoons is as follows: We use the "Deere" Bedder for stool cutting; apply 400 lbs. per acre right behind the plow; follow up with double disc astraddle the row, throwing dirt on top of the stool; then run Avery's Stubble Digger over the row to mix the fertilizer and soil together and loosen the soil around the stools. We also try to bury as much of the trash as possible with the Bedder. Later on we cultivate down the middle and split them out with small plows, thoroughly loosening them up, always cultivating as often as we can with Planet Jr. cultivators.

Fertilizing consists of an application of 500 lbs. of tankage along with the seed, and two applications of 400 lbs. each of High Grade before laying past or finishing off.

Along in March, April and May, we generally apply a 200 or 250 lb. dose of Sulphate of Ammonia or Nitrate of Soda.

I know of no way to answer your question: What influence do weedy fields have on final yield of cane per acre? except by having experimental plots and trying it out. There is no question in my mind that the deterrent influence is very considerable, and although I cannot put it down in dollars and cents, I have observed on some of our fields where we were forced to suspend hoeing for a week or ten days, there was a marked effect on the cane, not only in height, but in the stooling out as well, and I doubt if a field can catch up again. In the raising of cane I consider it most important to keep the fields free from weeds; next in order is cultivation and fertilization. The cleaner the fields are kept, from time of planting to maturity, the better the yield provided everything else is equal.

I have always been in favor of high nitrogenous content of complete fertilization, but until this year have had the potash somewhat higher than ammonia, in the High Grade. But taking into consideration that we apply 500 lbs. of tankage with the seed, per acre, the analysis of same being from 11-12% Ammonia, which would bring up the percentage of ammonia applied per acre to equal or even exceeding the total of the other ingredients, and from this formula we have always had good results.

Green-soiling, I am sorry to say, has proved an utter failure here. Three varieties of cow peas, Velvet Beans, Mauritius Beans, Lupines, Alfalfa, Beans and Peas imported from Great Britain, have all been tried, and we have not been able to get any of them to make a crop, not even with fertilization.

Cultivation.—There is nothing new to report on this matter. Simply keep the soil free from weeds and properly loosened up to let the sun and air into it. In this district, where it rains so much, keep the harrows and cultivators going over the fields as often as it is possible, breaking the crust that is formed by heavy rains, while the cane is small and before it covers the ground; then leave the bottoms of the rows thoroughly subsoiled, which is very necessary for either wet or dry localities.

This last season we applied the Hydrated Lime to our fields with a machine called the "Westphalia," spreading it broadcast, giving a very even distribution. This machine will handle ground Caustic Lime equally as well, and is made in several sizes, all the way from 5′ to 13′ 3″ spreading width. Ours has a spreading width of 10′, which we find quite wide enough, and it carries load enough for two animals. The quality of its work leaves nothing to be desired, and it is so arranged that it will work well even with a stiff breeze blowing, having a double set of tail boards reaching nearly to the ground for the lime to drop down between.

Another labor saving implement is the International Harvester Company's Manure Spreader. We use them to cart out and spread our press cake and stable manure, and sometimes lime as well. With this machine you can load your wagon, drive into the field, put your clutch in, drive your team along, regulating the quantity desired by a lever at the driver's side, until the wagon is empty. Its principal advantage is the equal distribution without hand labor.

Yours very truly,

(Signed) JOHN T. MOIR,
Manager Onomea Sugar Co.

SUPPLEMENTARY LETTER BY MR. JOHN HIND.

Kohala, Hawaii, Oct. 30th, 1909.

Mr. A. Lidgate,
Chairman of Committee on Cultivation and Fertilization on Unirrigated Plantations,
Paauilo, Hamakua.

DEAR SIR:—Yours of 19th instant to hand, and regret to say the questions propounded are rather beyond me.

I have frequently been obliged to allow fields to become overgrown with weeds and grass, and my experience has invariably been, that such fields as a whole, though kept thereafter reasonably free of weeds, never looked so well as other fields which had proper attention; but as our seasons are never twice alike, the results vary considerably, and in a few instances the yield would seem to indicate but little loss had been sustained, by being during its early stage choked with weeds.

My experiments with fertilizers on unirrigated fields have not resulted in any very definite conclusions. During favorable seasons good results are very evident but followed often by a year when it would seem fertilizers used on this plantation on unirrigated fields were a waste. This may not seem sound to managers whose plantations are more favored by more regular seasons than

this, but it has resulted in a somewhat diminishing use of fertilizer here.

I have used nitrate of soda to considerable advantage, and yet again there have been instances when the results have hardly warranted the expense.

Regretting I cannot more satisfactorily answer your questions, I remain,

Yours very truly,

(Signed) JNO. HIND.

SUPPLEMENTARY LETTER BY MR. W. P. NAQUIN.

Olaa, Hawaii, T. H., October 27th, 1909.

Mr. A. Lidgate,
Chairman of Committee on Cultivation and Fertilization.

DEAR SIR:—In answer to your inquiries about the cultivation and fertilization of cane on non-irrigated plantations, I beg to submit the following:

The keeping out of weeds in fields of non-irrigated plantations is one of the main problems confronting us. Weeds are the greatest enemy a cane field can have. No field will produce a full crop of cane if not kept reasonably clean from weeds during the entire period of growth. Weeds will not only destroy young cane, but will also, if not removed, rob the soil of the available ingredients which rightly belong to the cane. Weeds will also prevent proper aeration of the soil, lower the temperature, and thereby retard nitrification. Especially is this so in the uplands, where the decomposition of soil is slow, due to the low temperatures and the excessive amount of moisture in these soils.

A field which has once been overrun with grass will never, under similar treatment, produce what it would have produced if kept clean, and cannot gain what it has lost—time. I have in mind a small patch of cane which was kept clean during its early period of growth, and which is surrounded by cane of the same age and growing under identical conditions, with similar treatment throughout. The cane in the clean area, within a row, looks far better and is at least two months ahead of the other, within six feet of it. Not only will the cane kept clean be ready to lay by much earlier, but it is also in a better condition to utilize any fertilizing material which may be applied, and the ultimate result is quite obvious.

Fertilization.—The finding of the Experiment Station as to the importance of nitrogen as a fertilizing ingredient is in accord, I believe, with what most of us are beginning to realize. The Station had, on several occasions, alluded to the importance of this element in hastening plant growth, but most of us were rather skeptical about adopting any change until the recent data was published.

At Olaa, we are now using nitrate of soda and ammonium sulphate to increase the nitrogen content of our fertilizer, and the results in the fields are quite marked.

Very truly yours,

(Signed) W. P. NAQUIN,
Field Chemist, Olaa Sugar Co., Ltd.

REPORT OF COMMITTEE ON THE MANUFACTURE OF SUGAR AND THE UTILIZATION OF WASTE PRODUCTS.

The Hawaiian Planters' Record.]

President, Trustees and Members of the Hawaiian Sugar Planters' Association,
Honolulu.

GENTLEMEN:—Your Committee on the Manufacture of Sugar and Utilization of Waste Products, addressed a letter to each plantation manager, asking for information about new methods of manufacture and new ways of utilizing waste products.

The answers received show that during the past year few changes have been made. The most important change in crushing was at Ewa, where, during a part of the season, the cane passed through five 3-roller mills. The results were encouraging, and the reports show high extraction with rapid grinding and low per cent. maceration.

Careful examination of the mill reports compiled by the Experiment Station, fail to show any results to prove that any mill of the 5, 6, 8, 9, or 12 roller type is superior to any other mill of the same class. Conditions under which they are working, vary, and unless we know these, comparisons are misleading.

High extraction of sucrose from cane depends not only upon the setting of the rollers and returner bar, but also upon the regular supply of cane of uniform sugar content and fiber; these ideal conditions rarely obtained at any one time, and the speed at which the mill must be run in order to take off a crop within a given time, are factors not within the control of the mill engineer.

Losses in extraction in many of the mills are higher than they would be if the canes ground were not of different varieties, grown at different elevations, and varying in fiber and sucrose.

H. C. Prinsen Geerligs, in his work on "Cane Sugar and Its Manufacture," on page 105, says:

"INFLUENCE OF THE CHARACTER OF THE CANE FIBER ON THE EXTRACTION OF THE JUICE.

"It is advisable in every factory to control the mill work according to the sucrose and water content of the last bagasse, and to regulate the maceration by the specific gravity of the last mill juice. The more powerful the mills are, the more work may be claimed of them, and the drier and more exhausted will the bagasse be. But as extraction is not subject to fixed rules, no exact figures can be given. Factories equipped with a large evaporating plant and sufficient steam, may go farther with maceration than those where stoppage in the course of working, owing to want of capacity, is to be feared. Besides this, copious maceration will be more in place when crushing cane with juice of a high saccharine content, than in cases where poor cane has to be worked up. In any case, the extent of the maceration is regulated by taking care to maintain the diluted juice from the last mill at the same specific gravity. When crushing canes having a rich juice, more maceration water will be required to dilute the last portions of it to the fixed specific gravity than when a cane with a poor juice is crushed, and thus the maceration is regulated by the constant testing of the last mill juice by the Brix hydrometer so as to obtain bagasse containing juice with an invariable quantum of dry substance. Owing to the circumstance that the Brix hydrometer only ascertains the quantity of dry substance and not that of sucrose, the sucrose content of the bagasse cannot be regulated in the same exact manner, but the proportion between dry substance and sucrose does not differ so much in the same factory that any great mistake can ensue.

"If it were possible to crush the bagasse of the different cane varieties always to the same juice content, it would be feasible to obtain a constant sucrose content in the bagasse by keeping the density of the last mill juice constant. The quantity of juice extracted from 100 parts of cane would then only depend on the amount of fibre, and this quantity diminishes for two reasons when the amount of fiber rises. Firstly, cane with much fiber contains a proportionately smaller amount of juice, and secondly, the quantity of bagasse is increased, and hence also the quantity of juice which it contains and that of the sucrose in it which is to be eliminated.

"It is not, however, quite so simple, because the fiber of every variety of cane has its own power to resist pressure. Thus the Java seedling No. 247 yields a dry bagasse much more readily than No. 100 or the black Java cane, and in most cases, canes having a high fiber content will yield a bagasse, the fiber of which offers but little resistance to pressure. This to some extent compensates for the increased loss of sugar occasioned by the large amount of bagasse obtained from canes of high fiber content.

"From the average of a great number of determinations it is

seen that a high fiber content of the cane corresponds with a high fiber content of the bagasse, so that a hard cane yields a drier and more exhausted bagasse than a soft one.

"Very probably the considerable difference in juice content of bagasse of soft and hard canes when crushed in the same mill, in a layer of equal thickness, is occasioned by the difference in the absorbing power of the fiber. The fiber of soft cane is more spongy than that of hard cane, and therefore absorbs more juice than the latter. At the moment when the bagasse is relieved from the heaviest pressure all of the expressed juice has not escaped out of contact with the bagasse, and a film of juice still remains on the rollers, consequently the expanding fiber readily absorbs whatever juice remains in contact with it, although such juice has already been expressed from it. The more spongy the fiber the more it will absorb, and though this is still an unproved hypothesis, it may explain why soft cane yields bagasse containing so much more juice than does hard cane.

"The loss of sugar in bagasse on 100 cane has not been materially reduced in Java during the last few years, but the per cent. of sucrose in the bagasse has greatly decreased during that time. The milling plants have been improved, and at the same time the cultivation of canes carrying a higher percentage of fiber (and thus yielding a less resistant bagasse) has been extended, which two circumstances have tended toward reducing the sucrose content of the bagasse.

"On the other hand, the high fiber content of the canes has increased the total amount of the bagasse per 100 of cane, which causes the figures for sucrose lost on 100 cane, to revert to their former value." * * *

Boiling house results are seriously affected only when the mill is run beyond the capacity of the apparatus.

The compiled reports show that little has been done to check or diminish the ordinary losses in handling juices, syrups or molasses. They vary in amount in the different mills in all the different departments from clarification to deterioration of the sugar in storage and in transit.

The direct losses in manufacture average 7% of all the sucrose in the cane and a slightly higher percentage of the sucrose in the juices.

Totals of the money loss in all departments of the boiling houses for the crop of 1909 may be estimated at $2,500,000. The losses are shown under the three heads:

1st. Undetermined; largely entrainment, and an actual waste.

2nd. Scum Press Cake.

3rd. Molasses.

Both of the latter are by-products and capable of being utilized.

The losses in sucrose while in transit between the mills and refineries do not come within the scope of this report, as data were neither asked for nor supplied.

The reports of your Committee show that scum press cake is very generally used as a fertilizer, and with good results. Molasses is used for fuel, for stock feed and for fertilizer, but the quantity so used is a small percentage of the whole.

We have received some valuable reports on these subjects, from plantations on the islands, and submit them with this:

Mr. Jas. W. Donald, chemist for the Honokaa Sugar Co., reports as follows:

Honokaa, Hawaii, November 4th, 1909.

W. W. Goodale, Esq.,
Chairman, Committee on Manufacture, H. S. P. A.,
Waialua, Oahu.

DEAR SIR:—At the request of Mr. K. S. Gjerdrum, I beg to submit a few remarks on Manufacture and Utilization of Waste Products, and trust these will prove of interest and value to the members of the Hawaiian Sugar Planters' Association.

There have been no improvements or changes of note in sugar making processes during the past year. The manufacturing losses and their causes are all well known and, in these islands, have been reduced to near the limit of practical possibility. Any further returns from our cane may be looked for not so much in greater recoveries of sugar as in more perfect organizing and systematizing and in turning the by-products into marketable or locally valuable products. By systematizing I mean applying the same scientific control to the cost of manufacture that is now applied to the recovery of sugar. With many expenses—such as those for oil, waste, piping, bolts, etc.—there is little supervision required; they are apparent to the senses and no particular skill is required to keep them within reasonable limits. Others, such as those for lime and bags, cannot be regulated at will. But the most important of all, the consumption of fuel and steam, can be raised from the present empiricism and placed on the businesslike footing given to it in all large industries. When we install an electric generator and circuit we do not rest content with a voltmeter to tell us what we are doing, but with a steam system we seem to desire no more information than that afforded by a few pressure gauges. In the boiling house it would be no great problem to dispose of all the steam the boilers could produce without making a pound of sugar and without affecting the pressure gauges. But if the *quantity* of steam going to each steam using apparatus could be accurately measured we would have an invaluable check on the consumption of steam. This measurement is not only feasible, but comparatively easy. There are several methods and instruments for the purpose, but the simplest is probably a steam meter, which has lately been put on the market by

the Farbenfabriken Company of Germany. The instrument registers continuously the sectional area of the varying opening through which the steam is passing and also the pressure, and thus enables us to determine (within an error limit of 1 per cent.) the actual weight of steam which is being consumed. The practical value of such an apparatus needs no demonstration.

As regards fuel economy, the great importance of continual supervision of conditions and results cannot be exaggerated. Mere forcing of bagasse into the furnaces and watching the flames rushing and the pressure gauges moving, without intelligent observation of the composition and temperature of the flue gases and consequent regulation of the quantity and temperature and *place of entry* of the admitted air, is culpable wastefulness. It is well known that imperfect combustion due to too little or too much air, or too cold air, or any one of a number of causes, results in an enormous loss of fuel, and yet there is no systematic attempt to prevent this loss. Mr. A. W. Keech, who has made a long and thorough study of this question, writes to me as follows:

"The principles of combustion are well known. The quantity of energy liberated when certain reactions occur is well known. Yet there is a general lack of knowledge concerning conditions for producing economical results. This is not due to general ignorance and stupidity. Indifference and the conditions under which the reactions occur are responsible. The invisible is less interesting than the visible. When the fuel is a gas the factors, reactions and products are invisible; and, with a liquid or solid combustible, the fuel only is visible. The most familiar form of combustion producing the greater heat energy (steam making) is non-luminous or faintly so. The Bunsen burner demonstrates the comparative value of the luminous and non-luminous combustions as heat makers.

"Any furnace, and a bagasse furnace in particular, must fail in efficiency when combustion is produced by passing a current of air through a layer of fuel on a grate *only*. The oxygen of the air is consumed while the inert nitrogen passes through. To supply the body of the furnace with oxygen an excessive quantity of air must be supplied. The true function of the grate is a gas *producer* consuming the fixed carbon; to do so, as in a producer gas plant, the supply of oxygen for the body of the furnace must *not* come by way of the ash pit doors. An economical furnace must be the combination of a producer gas plant and a Bunsen burner. The Dutch oven construction is the best form of furnace chamber for any fuel if made to act as a producer and consumer.

"I wish to call attention to the prevailing mistake of confusing boiler efficiency with furnace efficiency. There is no considerable variation of efficiency among the prevailing types of boilers that have survived experiment. This includes the cylindrical tubular boiler of suitable diameter and length. They are all good steam generators if supplied with heat. There is a great variation in

furnace efficiency and whatever may be the possibilities of the boiler it is evident that it depends wholly upon its furnace. The cause of failure in furnace efficiency as compared with the theoretical value of the fuel can be easily shown, but the demonstration is too lengthy for the present. Briefly stated, the best ordinary bagasse-burning furnace, producing combustion by drawing air through the layer of fuel, requires too much air—is slow and uncertain of reaction in the furnace chamber producing the *luminous* flames and low temperature—has excessive volume of products and liability to smoke causing a more rapid movement along the heat absorbing surface and finally too high temperature at the exit.

"The economical production of heat requires the fuel to be gasified on a diminished grate area by a greatly diminished volume of air through the grate. The admission of very hot air into the body of the furnace of just sufficient quantity to consume all the burnable volatiles, highest possible temperature in the furnace chamber without luminosity, and chemical combination practically complete before passing the furnace throat, reduced volume at high temperature and longer contact with heat absorbing surfaces giving normal temperature at exit.

"I am convinced that the efficiency of the best grate combustion furnace as ordinarily constructed is not above 50%. An improvement on this of 50% thus raising the total efficiency to 75% is not unreasonable. It is also a considerable item where fuel is needed. The Bunsen burner's action can be radically changed by a very slight movement of one part. A radical change can be effected in the Dutch oven ordinary furnace by slight alterations as required to produce the non-luminous combustion."

This short resumé of the fundamental principles of industrial combustion shows the very large improvements that are possible in the use of fuels in our sugar mills, and Mr. Keech is ready to demonstrate the truth of these principles at length.

There is no need for a chemist in controlling the composition of the flue gases. There are registering thermometers and pyrometers on the market (such as the Bristol, Thwing, Leeds & Northrup, Heraeus Le Chatelier, Hoskins and others) and even continuous carbonic dioxide recorders (such as Simmance & Abady's) while the full analysis is simple and could be learned in a few attempts.

As part of the same question of fuel economy, the application of maceration water must be considered. Determining the quantity of water applied from the densities of the juices is inaccurate, and water meters or other means of measuring the water should be used. The extra quantity of juice which is obtained as the result of such application, can be approximately determined, and a close watch can be maintained so that the extra fuel necessary is not of greater value than the juice obtained.

The by-products of a cane sugar factory are bagasse, filter-press cake and molasses. In countries where coal is cheap bagasse

may be used for paper making and other purposes, but here in Hawaii it will probably never be put to more advantageous use than as fuel. With the adoption of efficient devices for utilizing the waste heat in flue gases, the heating value of bagasse can be greatly increased by drying.

Press cake is now used only as fertilizer, but recently it has been suggested to extract and refine wax, of which it contains (in Java) 10 to 12 per cent. on the dry substance. This wax is hard and of high melting point, resembling Carnauba wax, and it could be readily marketed. The process of manufacture is simple, consisting in a drying of the cake, extraction of the wax by benzine and refining by recrystallization. There are no data available as to the yield and cost of production in the Hawaiian Islands. In this process the mudcake loses none of its fertilizing value.

The by-product from which a considerable revenue may be expected is molasses. The report of Mr. J. N. S. Williams to the H. S. P. A. some years ago on the cost of production of denatured alcohol, and Messrs. Peck and Deerr's recent exhaustive investigations of the molasses problem, place at the disposal of the Planters' Association nearly all the facts and data which are necessary. I would venture to suggest, however, that a central distillery would *not* be more profitable than small distilleries at the sugar mills. The costs of transportation and of fuel would be very large items in the total cost of production, and would be absent in a distillery connected to a sugar factory using the methods of fuel and steam economy outlined above.

Respectfully yours,

JAS. W. DONALD,
Chemist, Honokaa Sugar Co.

Mr. G. Giacometti, Chemist for the Olaa Sugar Co., writes on methods of manufacture and utilization of waste products, as follows:

Olaa, Hawaii, T. H., October 27th, 1909.

Mr. J. Watt,
Manager, Olaa Sugar Company, Ltd.,
Olaa, Hawaii.

DEAR SIR:—In reply to your request for a report on sugar manufacture and utilization of waste products, I beg to submit the following:

One of the most discussed points about the grinding of sugar cane is the percentage of sugar lost in the bagasse. Although our method of control is mathematically correct, still the difficulty in procuring reliable data for the amount of fiber and trash in cane,

renders the result subject to discussion. For the plantations where the cane is railroaded and weighed, it would be better to arrive at the so-called extraction by an indirect way, as follows: Weigh the cane, the water of maceration and the juice by means of suitable scales, and determine by analysis the percentage of sucrose in the mixed juice and the bagasse. The weight of bagasse is equal the weight of cane, plus maceration water, minus the weight of mixed juice. In this way a much more reliable extraction can be calculated, as only the determination of the percentage of sucrose in bagasse remains of a somewhat delicate nature. Still, any one familiar with the work will admit that it is by far easier to obtain a closer average percentage of sucrose in bagasse, than a percentage of fiber and trash in cane. It is evident that any method which will give us better data on any work performed, by dispelling any wrong impression, will lead us to improvements in the work itself.

Regarding the best paying polarization of the sugar, although a theoretical gain seems to be possible on the eastern market with any increase above the standard, the general practice, with a few exceptions for this country, is a product polarizing 97, or thereabouts. This, in my opinion, is a very good practice, as sugar at 97 can be produced with the same boiling method as that used for 96. As soon as a higher polarization is wanted, boiling of pure syrup and re-melting of the low grade products is necessary, a practice which is certainly obsolete for raw sugar mills.

Many sugar houses are replacing the old coolers and tanks by crystallizers, at no small expense, in the endeavor to eliminate altogether, or reduce to a minimum, the low grade product which must be re-melted. There is no excuse for the use of crystallizers for the manufacture of sugar unfit for the market, and which must be worked over, unless it is ignorance as to how crystallization in motion has to be conducted.

The only by-product in our mill which still awaits a satisfactory disposal is the exhausted molasses. Although the amount of sugar lost in this product in the Hawaiian mills compares very favorably with the losses in other sugar countries, the molasses which runs to waste is of considerable value.

Messrs. Deerr and Peck, in Bulletin No. 28, have made an exhaustive study of our waste molasses as a source for the manufacture of alcohol, and it seems very hopeful that this new industry will be established and solve the problem.

In the mean time, attempts have been made to utilize the waste molasses as a supplementary fuel. In our mill, for instance, the thermal value of this product has been fully demonstrated, when burned through properly constructed injectors. Besides the thermal value, some of the potash contained in the molasses can be recovered in the ashes and flue dust. Analysis of flue dust, as carried out in the past, showed about 4.5% water soluble, and 16.5% acid soluble potash, as against 2.5% and 13.0% respectively, for the ashes.

Another profitable disposal of waste molasses, in fact the best, according to some authorities, would be to use it for fattening stock. I think that for plantations, favored by local conditions as proximity to a cattle ranch for instance, as in the case with Olaa, it would pay to thoroughly investigate this possibility.

As the fertilizing value of the press cakes has been recognized by all, and this by product is returned to the field in one way or another, it remains only to consider how this can be done to the best advantage. The usual process is to bag the fresh mud alone or mixed with dry dirt. The high content of water, and its soft and pasty nature, renders the transport and scattering of this material unnecessarily expensive. It would therefore seem more rational to dump the mud during the grinding season, under a shed and leave it there to dry. The fermentation which the mud soon undergoes generates enough heat to evaporate the water, and, what is very important, causes a rapid disintegation of the vegetable bodies. This disintegration is more rapid in the stored up mud, which is strongly alkali, than on the field where the lime can be washed out by rain.

In the off season the dried mud can be pulverized through a disintegrator, and it is in fine condition for scattering on the field. I even think it could be used to still better advantage by making it the basis for some of the plantation fertilizer. Through a mixing machine the necessary elements in a concentrated form could be added so as to correct its original composition and turn out a compound according to the diluted formulas mostly employed on our fields at a much cheaper cost. Of course, this is merely a suggestion and no details need be gone into, but it seems to me worth investigation.

Trusting that these few remarks will be of some help in covering the ground, I remain,

Very truly yours,

G. GIACOMETTI.

Mr. Geo. Ross, Manager of the Honolulu Plantation Co., and a member of this Committee, contributes the following report on Manufacture.

His reference to the burning of cane before cutting is interesting at this time, when so much attention is being given to that subject:

Mr. W. W. Goodale,
Chairman, Committee on Manufacture of Sugar and Utilization of Waste Products.

DEAR SIR:—I do not know that there is anything that I can refer to in the process of raw sugar manufacture, or in the prevention of losses in our mills that is new to the members of the association, or that would be of interest in your report.

The principal loss, after the juice is expressed from the cane, is in the residual molasses and as the quantity and sugar content of this molasses is in direct ratio to the purity of the masecuite of first boiling, the loss through this medium is governed by the molasses forming constituents of the cane juice present in the concentrated juice as it is taken into the vacuum pan. This loss is also influenced by subsequent methods of boiling and treatment of low masecuites, and although all of us do not use like methods in eliminating impurities, nor in the subsequent processes of extracting the ultimate yield in crystalized sucrose, the methods in all well equipped sugar houses are largely alike, and results should only vary as the initial purity of the juices entering the different mills. There is a formula for determining the rendement, or recovery in commercial sugar, according to the density and purity of the mixed juice, and Mr. Noël Deerr, in compiling his Synopsis of Mill Data for Crop of 1908, has added a column showing the possible recovery per 100 sucrose, in the juices handled in the respective factories comprised in the report, which increases its value for comparative purposes.

The use of formaldehyde for sterilizing purposes has of late come into pretty general use. At Aiea we had a good opportunity during the strike this summer to test its value in preserving juices. By its use dilute juice in the settling tanks showed no deterioration after standing twelve to fifteen hours.

Honolulu Plantation Company refines all its product, and the question of the keeping quality of raw sugar is not a live issue with us, and I have no observations to record on that particular subject.

As the practice of burning standing cane in the field is coming into somewhat general use, as a labor saving expedient, it may not be out of place to say something in this report of the behavior in the factory of juice from burned cane.

Towards the latter part of the harvesting season this year, part of the crop was burned, and tests were made of the juice from burnt and from unburnt cane from the same fields, the cane in both cases being taken from portions of the field where the soil and physical conditions were alike. The average of a number of analysis of juice from burnt and from unburnt cane showed scarcely any difference. Neither was there any difference in the keeping quality of the cane up to the third day, after which burnt cane deteriorated more rapidly than that which was unburnt. Some difficulty was experienced, however, in the refining department when working upon burnt cane, which it is hoped may yet be overcome, as the saving in labor and other advantages, such as better and cleaner cutting, better stand from ratoons, and destruction of borer beetles, makes a continuance of the practice desirable, and outweighs so far as I have been able to determine, any possible loss of sugar from burning. That there is some slight loss is evident, for deposited on the outside of more severely burnt stalks can be seen a sticky, syrupy substance, which, on being

scraped off, gave a dark brown solution resembling evaporator syrup, which gave reactions for both sucrose and glucose. Tests for caramel in this sticky substance gave negative results. It would therefore appear that although a small amount of sucrose may be sweated out of the stalk by the heat it is subjected to, it is not caramelized and what is not lost by destructive chemical change, consequent on exposure to the atmosphere, may be subsequently recovered in crushing. The loss in this way, however, must be very slight, since there is no lowering of purity in the expressed juice.

In the report of the Committee on the Utilization of Waste Products for 1908, of which I was a member, I referred to the practice in Queensland of burning waste molasses in a special furnace for the potash contained in the ash. Since that time I have received from Mr. W. E. Desplace, manager of the Gin Gin Mill, Queensland, blue prints of two types of furnaces in use there for this purpose, together with his description of the construction and working of same. I enclose his descriptive letter herewith, and will be pleased to send you the blue prints, should you so desire.

During the season just closed, I tried burning molasses in the furnace of our lime kiln, both for its fuel value, and for the potash. We made a considerable quantity of ash, which was used as fertilizer, in conjunction with phosphate and nitrate in quantity corresponding to the composition of our regular mixed fertilizer.

Messrs. Peck and Deerr, in their report on the alcohol producing value of Hawaiian waste molasses, do not think that the yield in alcohol per gallon of molasses would be sufficient to meet the United States revenue requirements, to warrant its distillation upon a commercial scale, without a modification of present regulations, yet many distilleries on the mainland are operating upon beet molasses of no higher sugar content than Hawaiian cane molasses.

The Experiment Station has been conducting investigations in the extraction of wax from filter-press cake and the commercial value of same, and no doubt Mr. Eckart, the Director, will be heard from on the subject in due course.

I enclose herewith copy of a statement by Mr. J. A. Verret, plantation chemist, regarding our experience burning waste molasses in the lime kiln with the analysis of the ash from same.

Yours truly,

GEO. ROSS,

Member, Committee on Sugar Manufacture and Utilization of Waste Products.

Mr. Verret, Chemist for the Honolulu Plantation Co., reports as follows on Burning Waste Molasses:

Aiea, Oahu, October 18, 1909.

Mr. Geo. Ross,
Manager, Honolulu Plantation Co.

DEAR SIR:—Herewith I hand you a report of the results of burning the waste molasses from the factory during the 1909 season:

The molasses is burned in an ordinary continuous, three-furnace lime kiln. The furnaces have not been changed. The molasses is admitted at the back of each furnace from the top by means of a pipe leading through the brick work. The kiln attendant regulates the flow of molasses as occasion demands by means of valves on the pipes leading to each furnace. As the molasses burns the attendant rakes it towards the front, raking out the ashes as usual. On starting the kiln the furnaces must first be made red hot with a coal fire before admitting molasses.

The molasses does not make as hot a fire as coal, consequently, when burning molasses alone the capacity of the kiln is diminished about 50%, and it does not quite supply our needs. So we now burn a small amount of coal along with the molasses, the attendant throwing in a half a shovel-full when he rakes forward the molasses. Our lime capacity is now about 15 to 16 barrels per 24 hours as compared to 24 barrels with coal alone. We burn about 1,000 gallons of molasses a day. The capacity of the kilns being entirely too small to burn all of our molasses.

Our molasses contain about 11% of ash. The ashes from the kiln contains the following amounts of potash and phosphoric acid:

Burned without coal:	Potash .....(K_2O)	37.96%
	Phosphoric Acid.....(P_2O_5)	1.28%
Burned with coal:	Potash .....(K_2O)	28.98%
	Phosphoric Acid.....(P_2O_5)	1.29%
Burned with bagasse:	Potash .....(K_2O)	38.50%
	Phosphoric Acid.....(P_2O_5)	1.07%

Burning the molasses with bagasse gives a very nice soft ash, but it does not increase the capacity over molasses alone.

Respectfully submitted,

J. A. VERRET,
Chemist, Honolulu Plantation Company.

The description of a molasses burning furnace in use at the Gin Gin Mill, Queensland, by Mr. Desplace, is a valuable addition to the literature on this subject.

This was referred to by Mr. Ross.

DESCRIPTION OF MOLASSES BURNING FURNACE IN USE AT THE GIN GIN SUGAR MILL, QUEENSLAND.

By Mr. W. E. Desplace, Mgr.

Plate I shows a brick furnace, capacity of about 100 gals. per hour. After being started by a wood fire, the molasses falls in a number of fine streams upon the inclined hearth, over which the products of combustion pass; so it is soon heated to an incandescent state. Here the liquid molasses is partially charred, this process being continued on the successive steps. It is then allowed to burn right out on the fire-grate, and the ash is collected from the pit below.

Such furnace or furnaces can be so set that the hot gases may be led to a boiler for steam generation.

This furnace demands the attention of hand labor to work the partially charred materials from one sloping hearth to the other. It has been clearly demonstrated that once the material is first charred, it will burn itself to a *white ash* upon an ordinary fire-grate:

Analysis of molasses:

Sucrose	36%
Glucose	14%
Org. non-sugar	14%
Water	25%
Ash	11%

Approximate thermal. value = 3000 B. T. U's.

Apart from the caloric value of molasses, every ton should by combustion yield about 96 lbs. of potash worth say £1 (sterling).

In practice, however, it is found that as the potash is very volatile, a considerable portion passes up the chimney with the waste gases. This cannot, however, be said to be lost for under ordinary circumstances, it settles from the atmosphere on the surrounding cane fields.

"ASH FROM MOLASSES."

Potash 39%, Soda 4%, Lime 16%, Magnesia 8%, Sulphuric Acid 11%, Phosphorus 5%, Chlorine 10%, Silicon 7%.

Plate II shows another furnace with a revolving cast iron drum, substituted for the fixed inclined hearth, and that is supported in a position partly over the fire-grate from which it receives the necessary heat. The principle thus aimed at is the constant provision of a clean and red hot iron surface for the streams of molasses to fall upon and become charred in a regular continuous manner prior to being automatically fed to the fire-grate underneath where the burning is completed and the ash removed from the pit below.

This furnace is also started with a wood fire, as a coal fire

would spoil the first yield of potash, and when the drum gets to a dull red heat, the feed of molasses commences and should continue night and day, because as the heat is very intense (estimated 2000 deg. F.) it is obvious that frequent heating and cooling off tends to increase the cost. To maintain the drum at a suitable temperature, a door is arranged at the back for the admission of cold air, also for ready inspection. A water cooled scraper suitably balanced to bear against and keep the drum clean is fitted on. The fire bars are of square section and are revolved at intervals to let the ash fall through.

The drum is composed of five separate cylinders bolted together for easy renewal of any part (one of such furnaces has worked two years without need of repairs). It is connected to a heavy cast iron hollow shaft by arms specially angled and pin jointed to allow for excessive expansion and contraction, and the shaft is supported on roller bearings and revolved by means of worm gear. The walls of the furnace are heavy and lined with fire bricks.

The capacity is over 100 gals, per hour; one man attends to the regulating of the molasses and bags the potash.

The power required for revolving the drum is almost negligible.

Mr. J. E. Biela, Chemist for the Laupahoehoe Sugar Co., states the methods he considers best, for saving the greatest part of the sugar in the waste molasses:

Papaaloa, T. H., Oct. 25th, 1909.

C. McLennan, Esq.,
Manager, Laupahoehoe Sugar Co.,
Hawaii, T. H.

DEAR SIR:—With reference to the request for information regarding "anything new in the way of preventing losses in our mills" contained in the letter from Mr. Goodale, Manager of the Waialua Agricultural Company, Ltd., which is herewith returned, I have the honor to submit the following remarks:

WASTE MOLASSES.

This by-product is the source of at least one-half of the losses encountered in the process of sugar manufacture as presently conducted in the Hawaiian Islands, and much attention has already been devoted to the subject. In my opinion, the limit has now been almost attained in the economical extraction of the sucrose from the waste molasses and I consider the aim, in sugar manufacture should now be to *reduce the quantity* of residual molasses by departing slightly from the usual method of manufacture.

I hold that this can be done by taking back the first molasses in the boiling of the first sugars, until it is brought down to 50-55 purity, at the same time producing a sugar of at least 97 polarization, a result obtained in your mill by using steam in the centrifugals.

By this process, the boiling of second grade sugar can be avoided, as the molasses of above-mentioned purity, will produce a massecuite equal in composition to that derived from molasses of second grade sugars,—in fact, much lower, in many cases, especially where syrup has been used to form the grain for the second product. The boiling and cooling capacity will also be increased considerably and the boiling of fourth massecuite entirely dispensed with. The following figures giving the result of an experimental trial on the lines indicated, seem to me to bear out my contention:

Boiled, third massecuite from molasses, (purity 55).

Dried, in about 7 weeks.

Obtained,

a. Sugar, polarization 77.5.
b. Molasses, apparent purity, 31.3.

Another direction from which I confidently look for the arrival of an additional economy in treating our waste products is in the adoption of some method of converting part of it into alcohol, as explained in a copy of the bulletin issued by the H. S. P. A. in an article entitled "Fermentation of Hawaiian Molasses."

With regard to minimizing the loss in "press-cake," I prefer to settle the mud rather than double-pressing. After three-fourths of an hour in the settling tank, the clear supernatant juice is drawn off, leaving a sediment containing about 20% of actual mud, which, when diluted, say 60% is pumped through the press. Of course, the previous dilution of the sediment materially reduces the sucrose content of the cake which, moreover, may be still farther reduced by subsequently washing the cake.

Respectfully submitted,

(Signed) J. E. BIELA.

Mr. E. Madden, Manager, Kukaiau Mill Co., says:

Hamakua, H. T., Oct. 21st, 1909.

Mr. W. W. Goodale,
Mgr. Waialua Agricultural Co.,
Waialua, Oahu.

DEAR SIR:—Yours of the 15th inst. is to hand. In reply to your request for material which might be worth while placing in your report of Committee on the Manufacture of Sugar and Utilization of Waste Products, for the next annual meeting, I would say, that I am sorry that I cannot give you any data on these lines, which would be worth while sending in. We have no

chemist here to make any proper tests, but as regards the actual manufacture of sugar we ship only one grade, using second sugars of between 85 to 90 degrees polarization as a matrix for our A sugar, and re-melting up C sugars in filter-press juice.

We have no crystallizers here, and in consequence we have very little choice left us as far as actual method goes, having to practice the old methods in use in such mills that are not equipped with these apparatus.

Our aim is to get as much A sugar of between 96 to 97 degrees and to work in the lower grades in the most convenient manner that our present mill equipment allows us to do.

You mention in the last paragraph of your letter "statement of difficulties in treating juices of different canes."

I cannot hand you any actual statement of our difficulties last year in handling juices, but we struck one rather unusual phenomenon here, which was that the juices took (all but) double the amount of lime per ton of sugar in 1909 than in 1908, and our sugarboiler complained to me of the extreme acidity of the juice.

At first I thought that he was mistaken, as the actual records of the amount of lime used last year (1908) were in my possession, but when he told me that he was using a great deal more lime this year I looked into the figures and found that he was quite right. The juices were in each case Yellow Caledonia, and the lime was the same both years, viz: "Roche Harbour," which we have always used here, season after season. Sugar and juices were more difficult to boil here than last year, and the crops as a general thing did not come up to expectations.

In regard to molasses, I may say that we burn a good deal of this, spraying same on the trash before it enters the furnaces, and the balance is fed to stock. We find that we save fuel by burning molasses.

I am inclined to think regarding the manufacture of the *best* grade of sugar for the market; that this will never be satisfactorily settled until some definite experiment is carried out by some one. At present, some say, make the highest polarizations that you can; others say, make one grade of sugar polarizing 96%. They cannot both be correct, and it is a large question, because so much will depend on local equipment of the mills, and final quantity, as well as quality of the resulting molasses from such experiments.

To produce sugar of the greatest selling value, some sort of method for filtration of the juice should be in vogue in order to get out as much of the foreign matter as possible, a poor grade of juice will give inferior sugar and also fall down in quantity.

Yours very truly,

E. MADDEN.

Mr. Jas. Gibb, Manager, Paauhau Plantation Co., says of the manufacture of sugar and utilization of waste products:

Paauhau, Hawaii, T. H., Oct. 21st, 1909.

Mr. Wm. W. Goodale,
Manager, Waialua Agricultural Co.,
Oahu.

DEAR SIR:—In answer to your letter of the 15th inst., requesting data for a report on the Manufacture of Sugar and Utilization of Waste Products, would say that I asked our sugarboiler, Mr. Lougher, to express his views on manufacture, which I enclose here, along with the following:

MANUFACTURE OF SUGAR.

At Paauhau we have continued making two grades of sugar, polarizing about 98° and 96° respectively, about 76% of the former and 24% of the latter grade,—or an average of 97° for the crop. Though it has been contended by many sugar men, for some years, that one grade of sugar, polarizing 96° or slightly over, is the most profitable method of manufacture, we are yet rather doubtful. The additional capacity required and labor to make one grade of sugar is a subject that has been fully discussed, and the details are familiar to us all. The possible retarding of the work in the boiling house by making one grade is liable to create an additional expense to the plantation by holding back the harvesting of the crop, that cannot be offset by the additional gain in the price obtained for the sugar. It seems to be still a mooted question with many practical sugar men whether the forced retention of impurities in the massecuite is not more a loss than a gain, by making more molasses than would otherwise be made if a more natural process of boiling were adopted. Another factor that should be considered is the better keeping qualities of the higher grade sugars. The method of manufacture adopted here is considered the best by sugar men in this district, even where one grade is now being made though by instructions.

UTILIZATION OF WASTE PRODUCTS.

In Hamakua the waste products are being utilized to as good advantage as conditions will warrant. In some mills the molasses are burned as fuel. In others it is run off and mixed with spare bagasse as fertilizer. Stock is being fed with molasses on all the plantations. Spare bagasse is used as fuel at landings or at other points where it is needed. It is also used extensively as bedding for stock. Press cake is applied as fertilizer on the fields.

Anything that can be done to deliver a clean, healthy crop of cane to the mill is a very important factor in considering by-products.

There is nothing further I can suggest on this subject at pres-

ent, but hope you may be favored with some information by others that may be useful to you in making up a report.

Yours very truly,

JAS. GIBB,
Manager, Paauhau Sugar Plantation Co.

Mr. Lougher, sugarboiler at Paauhau, writes of sugar manufacture as follows:

NOTES ON MANUFACTURE RE MR. GOODALE'S LETTER.

Through the whole process of the manufacture of sugar, the question of molasses is certainly the greatest problem to solve, and to do so we have to commence with the treatment of the juices. The making of dirty sugar of low polarization, 96°, has had a very demoralizing effect upon the clarification of our juices, encouraging dirty juice to be passed on into the manufacture, it being absurd to advocate clean juices when a dirty sugar is required, this fact constituting the source of trouble found in working the low grade molasses. We find that with a clean juice of say 87° purity, we can make sugars polarizing 98° without washing in the centrifugals, constituting approximately about 80% of the total sugar produced. We should not lose sight of the fact that the amount of available crystallized sugar depends on the purity of the massecuite, and the result of keeping the purity down, only increases the amount and sugar content of the molasses.

Referring to the clarification of the juice there are only a few mills that succeed in getting a complete clarification, that being accomplished by some mechanical device; the installation of excelsior filter tanks should be a feature of prominence in every sugar mill; they are slowly coming into use with marked results. The high extraction attained by our mills has a great effect on the purity of the waste molasses, to say nothing of the washing of the filter press cake. There being an economical limit, and going beyond that limit, would be only adding to the amount of waste molasses. High heat should not be tolerated in any part of the manufacture, except the process of clarification, a thing that is often met with in the blowing up of molasses and remelting the low grade sugars. I certainly do not believe in storing low grade molasses in bulk; each strike should be kept separate, and the temperature of boiling carefully noted that it don't get too high.

Cleanliness should certainly be encouraged in our mills; it is as necessary in the sugar mill as in our kitchens, where it is a constant condition.

With regard to the tempering of juices, I have found consid-

erable trouble at times; cane attacked with borer I attribute as one of the many causes, and also from this cause the sugar will *not* keep.

Respectfully submitted,

J. R. LOUGHER,
Sugarboiler at Paauhau.

At this time it may not be out of place to refer to the changes that have taken place during the 33 years that have elapsed since the ratification of the Reciprocity Treaty with the United States, when the sugar industry began its rapid growth in these Islands.

Mills at that time were spoken of as "5 ton," "10 ton," "15 ton" or "20 ton" mills. What was called a good mill included a 3-roller mill, old style clarifiers, cleaning pans, open evaporator, vacuum pan with walking beam pump, sugar coolers, Weston centrifugal, tubular boilers, engines of the old slide valve pattern and trash houses for drying bagasse.

One accustomed to the modern mills cannot realize the simplicity of the machinery and the crude processes of those days. On the other hand, however, machinery was of more artistic design, and in marked contrast to the plain, flat surfaces and square corners of the present day. There is as great a difference between the finish of the walking beam engine of the old Princeville mill, with its fluted columns and the bright ornamented connecting rods and polished brass work, and the Corliss engine of the present day, as there is between a $5,000 automobile and a road roller. Returner bars, gearing and mill pinions were made of cast iron; hydraulics were unknown; in some mills the king bolts were screwed up solid to the under side of the bed plate; other mills stood on huge timbers of Australian iron wood, the elasticity of which was supposed to counteract the evil effects of bars of iron passing through between rollers. There were several water power mills, with the water supply limited and variable; laboratories were unknown, the only apparatus used being a Baumé saccarometer. On plantations where cane was grown by outside planters, on shares, the sugar was divided on a basis of saccrometer tests of the density of the juices, and without reference to the sucrose in the cane. No tests were made of extraction, the losses in manufacture or the quantity and quality of the waste molasses. Three grades of sugar were made, and in only a few mills there were cisterns for fourth grades.

There was no way of computing extraction, which ranged from 60 to 75% of the sugar in the cane; the cane was not weighed and the juices were not measured. Settling tanks for skimmings were added later. Scum presses were unknown until Mr. Otto, manager of the Paauhau mill, introduced them, in about 1882,

He took out a patent under the Hawaiian law, for a scum press made of wood.

Double effects were introduced about 1880. Losses by entrainment were great, but no one knew it.

Engineers of those days were sometimes machinists, but many were not. Repairs were made in the blacksmith shop, and a repair outfit consisted, as a rule, of a set of pipe and bolt taps, a vice, hammers, cold chisels, an assortment of pipe tongs, and a few files and monkey wrenches.

Other losses in manufacture were enormous, and nothing but the high price of sugar, and the virgin soil saved the industry from failure. With sugar selling from $125.00 to $175.00 net, the business was profitable, but crops were small and plantation owners, though prosperous for those days, were not wealthy.

At about that time many of the mills erected were of the kind designed and built by Mirrlees, Tait & Watson, of Glasgow, for shipment to the British colonies. They were complete in every respect and all under one roof. The boiling house processes were within sight of the sugar boiler and within a radius of 50 feet. The mills were well arranged, cheaply erected, and efficient, allowing for the low standards of those days. Vacuum pans and other machinery from these mills can still be found in use, after more than 30 years, which speaks well for the quality of the material and the workmanship.

The demand of the growing industry for mills of greater capacity, led to the development of the Honolulu Iron Works, and the efforts of the men who have been at the head of that company and the credit due them cannot be overestimated.

The changes in standards and methods, and the improvements in results have been great. This is due to this Association and its predecessor, the old Planters' Labor & Supply Co., the Honolulu Iron Works Co., the individual members of the Association, both agents and managers, who have had the financial side in mind, and to the engineers, chemists and sugar boilers, who have set high standards of accomplishment for themselves and for the apparatus in their charge.

WM. W. GOODALE,
For the Committee on the Manufacture of Sugar and Utilization of Waste Products.

REPORT OF COMMITTEE ON WAREHOUSES FOR, AND STORAGE OF, RAW SUGARS.

The Hawaiian Planters' Record.]

Waipahu, T. H., October 11th, 1909.

S. M. Damon, Esq.,
President, Hawaiian Sugar Planters' Association,
Honolulu.

DEAR SIR:—As chairman of the Committee on "Warehouses for and Storage of Raw Sugars," I beg to state, that, the subject was so thoroughly treated in the reports presented at the last annual meeting of the Hawaiian Sugar Planters' Association, that there seems to be hardly anything new to add, and the Committee has therefore nothing of special interest to offer.

The attached copies of letters received from Messrs. Jas. Gibb and J. N. S. Williams, members of the Committee, indicate that the opinions expressed on the subject in the last year's reports, have by further experience been fully confirmed.

There is no doubt that warehouses constructed of corrugated iron, steel framed, with solid concrete floors, are the most preferable, both with regard to preventing sweating of stored sugar, and as a protection against fire.

The Oahu Sugar Co. built a modern warehouse of this class after the 1908 crop was taken off, and a brief description of its equipment may be of interest:

During the last four seasons we were compelled to store large quantities of sugar in temporary wooden warehouses, erected outside our mill, and being constantly troubled with more or less sweating of the sugar, particularly during showery and wet weather, it was decided to build a permanent warehouse adjoining the mill, large enough to hold as much sugar as we had ever had on hand. The building is 100 feet wide outside of the columns, 200 feet long on one side and 190 feet on the other in order to leave space for light to the adjoining mill building. One single row of columns in the center of the building support the trusses, which are 22 feet from the floor, allowing the sugar to be piled 35 bags high. Although during the past season we piled only 30 bags high, allowing a space of two feet between walls and tiers, and also around the columns in the center, we stored 6,500 tons of sugar, occupying about four-fifths of the floor space. The warehouse is equipped with a chain elevator, which starts in the center of the sugar room, and conveys the bags 30 feet high, almost through the middle of the building. From the elevator the bags are carried to the pile by means of chutes. This arrangement saves us eight men, and has the advantage that the sugar can be stored higher if it is necessary. The floor is provided with five cross-conveyors, which bring the bags in front of the railroad car doors. There are five sliding doors on either side of the build-

ing so that loading sugar can be carried on from any part of the warehouses, and five cars can be loaded at one time. The elevator as well as the cross-conveyors are driven by one 10 H. P. 110 volt motor, and can be operated all at the same time or separately as desired. The floor conveyors have a No. 88 link belt chain, while the one for the overhead carrier is a No. 103 chain; on both a F. No. 2 attachment is inserted every sixteen feet. The floor is made of concrete 5½" thick, and composed of one part cement, three sand, and five rock; the ¾" top-dressing is made of one part cement and two sand.

Neither the building nor the floor had been finished when we had to commence storing sugar; a layer of quicklime was spread on the floor so as to absorb the moisture from the concrete, but the lower row of bags was very much sweat damaged after being stored for three weeks. A bed of well dried bagasse, eight inches thick, spread over the floor kept the bags in good condition for about a month; those stored longer were stained more or less in the tier next the floor. Next season, when the concrete has dried out properly, we expect little trouble in this respect. The bags did not suffer any damage in being carried on the conveyors or in sliding down the chutes.

Respectfully yours,

E. K. BULL,

Chairman, Committee on Warehouses for and Storage of Raw Sugars.